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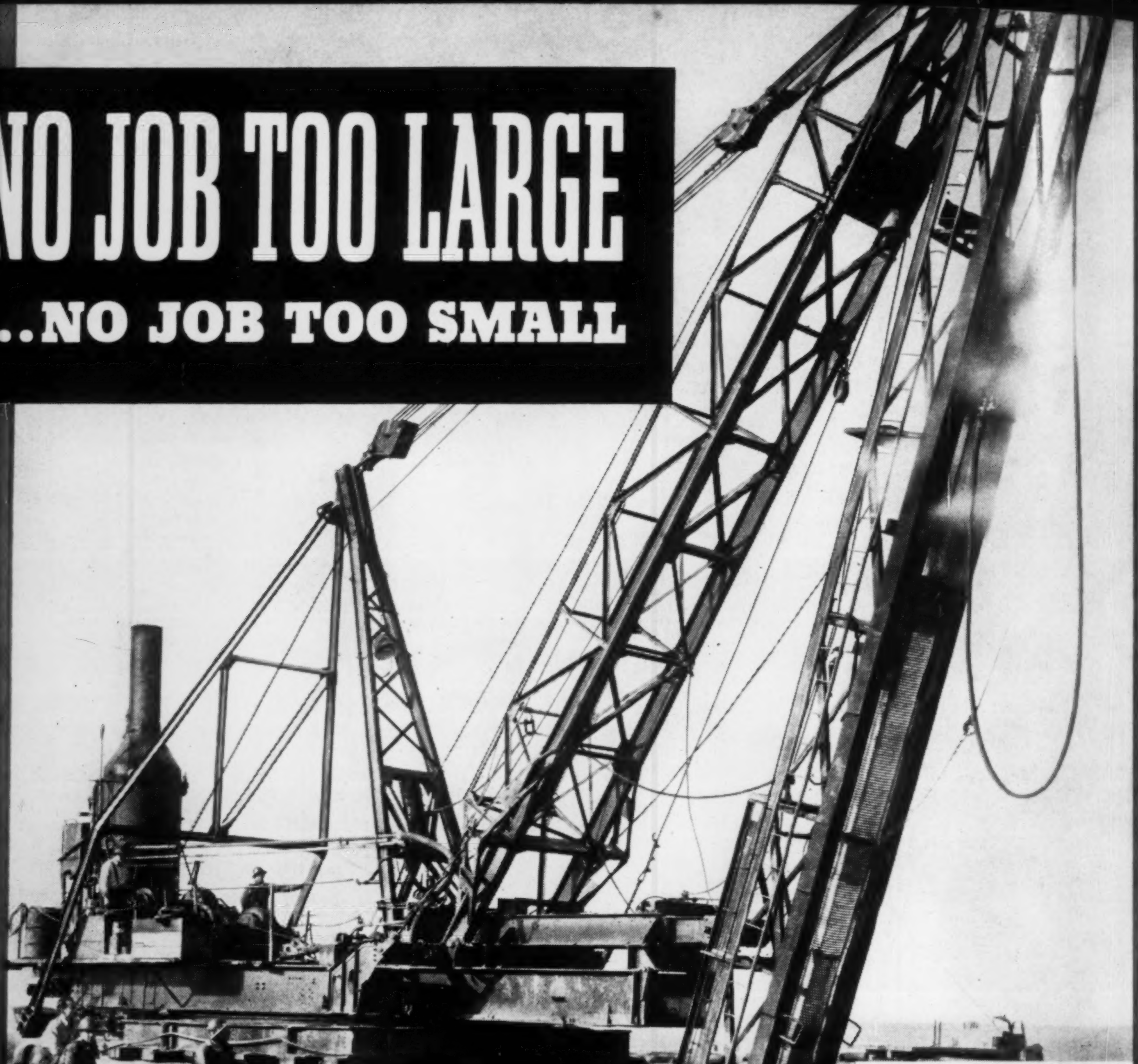
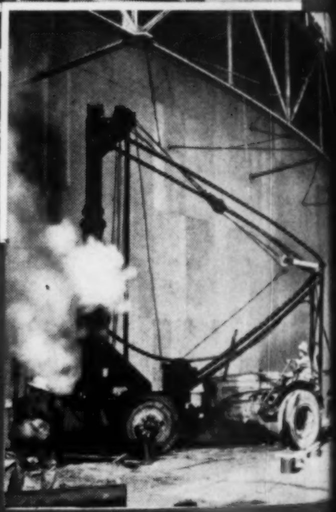
NDERPINNING of north abutment of Summit ridge, Maryland, by Corps of Engineers, prevents mminent collapse. See article by Col. F. F. Frech.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Prestressed Concrete Bridge Started in Philadelphia—Schofield
Phoenix Reconstructs Its Sky Harbor Airport—Johannessen
Flat Slab Permits Many Openings in Factory Floor—Wheeler
Philippines Initiate Hydro Construction Program—Rodriguez

NO JOB TOO LARGE
...NO JOB TOO SMALL





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JULY 1949
VOLUME 19 NUMBER 7

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CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• In This Issue

Army Engineers Save Summit Bridge . . . . *F. F. Frech* 17
Phoenix Reconstructs Its Sky Harbor Airport . . . . *Walter Johannessen* 21
Philippines Initiate Program of Hydroelectric Construction . . . . *Filemon C. Rodriguez* 25
Dutch Side-Haul Railway Drydock Speeds Assembly of Prefabricated Barges . . . . *J. Stuart Crandall* 28
Milwaukee Takes Long-Range View of Urban Highway Needs . . *Charles E. DeLeuw and William R. McConochie* 30
Construction Starts on Prestressed Concrete Bridge in Philadelphia . . . . *E. R. Schofield* 32
Large-Diameter Steel Pipe Replaces Power Flume . . . . *T. A. Purton* 35
Many Openings in Factory Floor Lead to Choice of Flat-Slab Construction . . . . *Walter H. Wheeler* 38
Tungsten Carbide Core Bits Expedite Subsurface Explorations in Canal Zone . . . . *Thomas F. Thompson* 41
Slide Rule Simplifies Open-Channel Computations . . . . *Christian W. Matthews* 42
Solution Presented for Trapezoidal Loading on Beams . . . . *Elihu Geer* 43

• Society News

ASCE Activities Studied at First Eastern Regional Conference 46
Washington, D.C., to Be Host to Fall Meeting 47
EJC Forms Committee on Engineers in Civil Service 47
Engineers Urged to Cooperate in EJC Survey of Professional Skills . . . 48
Student Chapters Receive Board Commendation 48
President Thomas Given Honorary Degree at USC 49
Notes from the Capital 50
Junior Branch of Metropolitan Section Sponsors Tour of Delaware Project . 51
News of Local Sections 52
Student Chapter Notes 57

• News Briefs

New Construction in May Increases 15 Percent Over April Total 58
Engineering Progress in Highway Safety Reported at President's Conference 58
Snow and Hydrology Groups Have Large Joint Meeting 60
Army Approves Building of Narrows Suspension Span 60
Drop in Construction Costs Is Predicted 61
Prof. Wilbur M. Wilson Awarded Marston Medal 62
Members Receive Prizes in AASHO Essay Contest 62

• Departments

Engineers' Notebook 41
The Readers Write 44
News Briefs 58
Construction Roundup 64
N. G. Neare's Column 66
Positions Announced 66
New in Education 70
News of Engineers 70
Deceased 74
New Publications 76
Recent Books 84
Equipment, Materials, Methods . . 86
Literature Available 91
Index to Advertisers 96

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Roadside Report

FORD *Bonus Built* TRUCKS ★ **M. W. LOGAN**
Miami, Florida

Ford Model F-7 BIG JOB shown, has Gross Vehicle Weight rating of 19,000 lbs.; Gross Combination Weight rating of 35,000 lbs. as a tractor.

"My 145-h.p. FORD F-7 Makes Two Extra Loads Per Day!"

"HAULING wet sand and pit rock, I find that my 145-horsepower Ford F-7 Big Job can get in two extra loads a day over trucks of other makes," writes Murray W. Logan of Miami, Florida. "We're getting 50 to 55 miles an hour in high gear—and exceptional pulling power in low speeds. Gas mileage comes to 7 miles per gallon, and maintenance costs have been nominal. In my opinion, no 2½ ton truck of any other manufacturer compares with the Ford F-7!"

Dump-truck operators like Mr. Logan are going all-out in their praises for the new 145-h.p. Ford Big Jobs. For one thing . . . the new Ford 337 cu. in. engine outperforms anything in its class. For another . . . there's the luxurious comfort of the new Ford Million Dollar Cab—mighty important in work on rough roads or off-the-road construction. And Ford Big Jobs are Bonus Built—a feature of every one of over 150 Ford Truck models. Bonus Built is the superstrong construction that contributes to long truck life. Life insurance experts prove Ford Trucks last longer.

ONLY THE FORD BIG JOB HAS ALL THESE FEATURES

- ★ New 145-h.p. Ford V-8 engine for top performance.
- ★ Ford exclusive concentric dual-throat carburetor for more power, more economy.
- ★ New heavy duty 5-speed transmissions—overdrive or direct-in-fifth—for operating flexibility.
- ★ Big Ford power-operated hydraulic brakes; front 16-inch by 2¼-inch; rear 15-inch by 5-inch double cylinder on F-7, 16-inch by 5-inch double cylinder on F-8. Air brakes also available for F-8.
- ★ Ford Super Quadrax single speed axles; two-speed axle available in Model F-8.
- ★ Large diameter (10-inch) wheel bolt circle with 8 studs to allow for extra-strong hub construction.
- ★ Million Dollar Cab with Ford Level Action suspension for greater driving comfort.
- ★ Nationwide service from over 6,400 Ford Dealers.
- ★ Ford Bonus Built construction for long truck life.

Gross Vehicle Weight ratings: F-8 up to 21,500 lbs., F-7 up to 19,000 lbs. Gross Combination ratings: F-8 up to 39,000 lbs., F-7 up to 35,000 lbs.

FORD 1949 *Bonus Built* TRUCKS 1949

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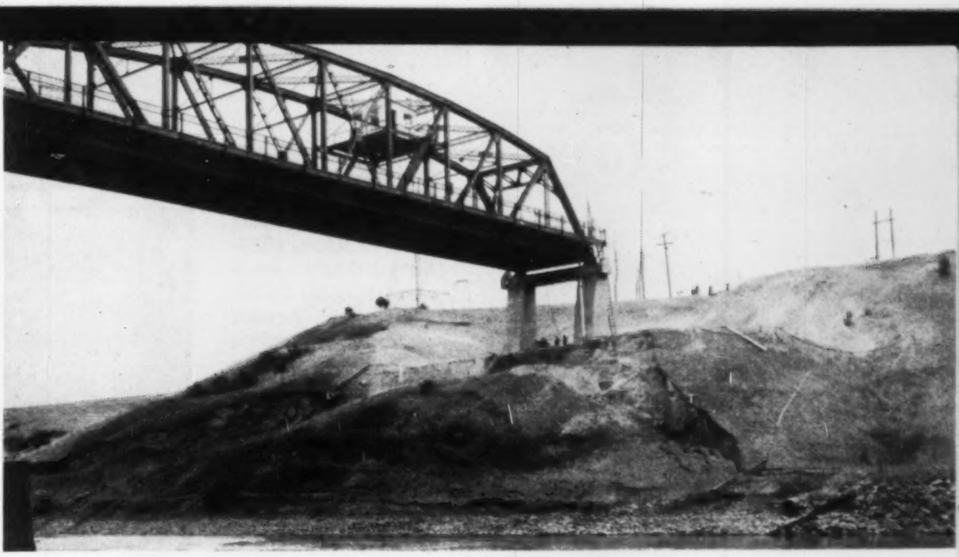


MASS MOVEMENT OF EMBANKMENT in front of north abutment of Summit Bridge over Chesapeake and Delaware Canal, Maryland, exposed abutment footing. Imminent danger of collapse caused Corps of Engineers to close highway over bridge. In photo 20,000 cu yd of embankment had already been removed to help stabilize abutment.

Army Engineers Save Summit Bridge

80-Ft Piles Underpin North Abutment of Maryland Bridge

F. F. FRECH

Colonel, Corps of Engineers; District Engineer, Philadelphia Engineer District

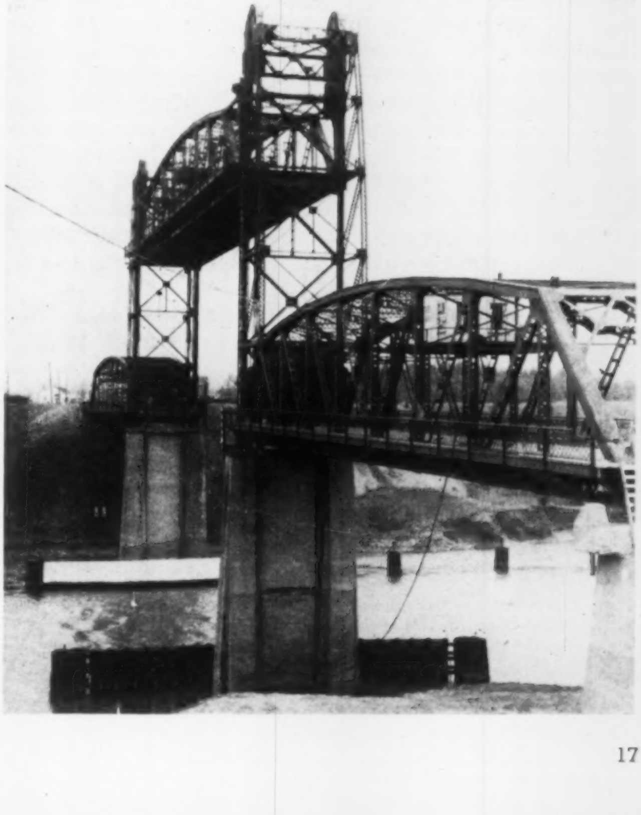
SERIOUS SETTLEMENT of the north abutment of the Summit Bridge demanded immediate action. After closing the highway over the bridge, the U.S. Army Engineers risked complete collapse by driving piles around the failing abutment to underpin the structure. The operation succeeded and three months after traffic was shut off the bridge was reopened.

SUCCESSFUL COMPLETION of a tricky underpinning job enabled the Army Engineers to reopen Summit Bridge to highway traffic on May 14 after closing it on February 12 when slides in the bank near the north abutment seriously threatened the 598-ft structure. This vertical-lift through truss over the Chesapeake and Delaware Canal is located 5 miles east of Chesapeake City, Md., in what is known as "Deep Cut," where the banks tower 80 ft above mean low water in the canal.

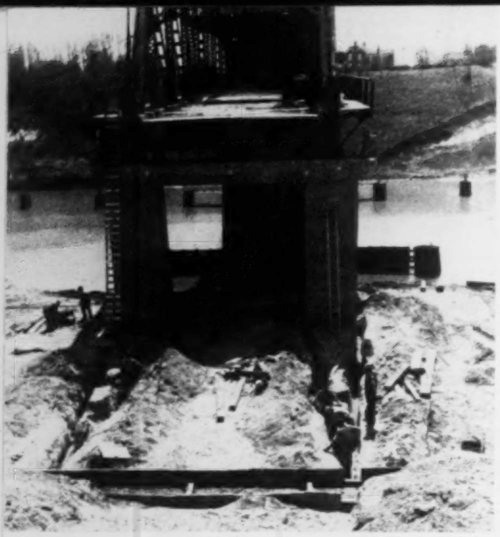
The bridge consists of two approach spans, each 194 ft long, and a vertical-lift center span 210 ft long. A 24-ft roadway with 6-ft sidewalks on each side runs across the bridge. The lift span has a vertical clearance of 72 ft in the closed position and 140 ft at mean low water when fully open.

The substructure consists of two main piers 210 ft on centers, located in the 27×250-ft navigation channel, and two abutments on shore which support the ends of the approach spans. The main piers carry both the lift-span towers and the outer ends of the approach spans. The north abutment consists of two concrete shafts 7 ft wide which taper from a 10-ft depth at the bottom to 5 ft 6 in. at the top, with a height of 25 ft. The shafts are founded on a concrete slab 15×40 ft and 4 ft deep. A concrete beam 6 ft wide and 3 ft deep between the abutment shafts supports the shore-end approach span, the load being introduced at the expansion shoes. These shoes consist of a bottom casting anchored to the abutment and a top casting pin-connected to the bottom chord of the approach-span truss. Provision for expansion due to temperature changes is made by means of six 4-in.-dia rollers which are located between the upper and lower castings.

At the time Summit Bridge was constructed in 1927, the canal had a depth of 12 ft at mean low water and a bottom width of 90 ft. The design of the bridge provided for enlargement of the channel to a depth of 35 ft at mean low water with an ultimate bottom width of 150 ft. Subsequent traffic, however, proved considerably greater than had been anticipated and in 1936 the channel was enlarged to a width of 250 ft, the depth being increased to 27 ft. The dredging of the canal to these dimensions necessitated cutting the bank slope directly in front of the abutment to a steep 1 on 1.75 slope.



VERTICAL-LIFT SPAN in raised position permits navigation of Chesapeake and Delaware Canal while bridge is being repaired. Tower in foreground, rigidly connected to approach span, moved 6 in. out of line at top when concrete abutment settled.



CONCRETE DEADMAN in foreground, tied to both shafts of abutment with $1\frac{1}{4}$-in. steel cables, resists further canalward movement of abutment.

It was recognized that this slope might jeopardize the structure, and observations were begun for the purpose of detecting any movement of this north abutment. This precaution was doubly necessary because of the history of previous slides in the banks of the canal in this area. When the canal was originally cut through, slides frequently occurred in the vicinity of Summit Bridge. After several years these slides became quiescent and did not appear again until widening operations were begun in 1936.

The regular inspection of the north abutment, which is embedded in the bank where these previous slides occurred, revealed a slight movement channelward and settlement periodically from 1936 to 1948. This channelward movement was compensated for by movement on the rollers in the expansion shoes. Eventually it became necessary to remove about 8 in. of concrete from the retaining wall in back of the abutment to permit further movement of the end of the approach-span trusses. However, early in 1949 it was noted that the movement of this north abutment had greatly accelerated. Evidence of an incipient slide appeared when the north approach road began to settle gradually. A fissure soon developed in the bank in front of and on the flanks of the abutment. Movement of the abutment caused one of the rollers in the northeast expansion shoe to roll off the lower shoe casting. The north lift tower, rigidly connected with the approach span, now had a total tilt of 6 in., measured at the top, because of progressive settlement in the north abutment, which now totaled 10 in.

DRILL RIG (right) places holes in transfer notches in abutment shafts for $2\frac{1}{4}$-in. tie-rods. Anchor plates (lower right) tie concrete in transfer notch to concrete in abutment shaft. Tie-rods below anchor plates take induced horizontal thrust of transfer notch.

The accelerated rate of settlement made a sudden failure of the structure likely, and even if a failure did not occur, there was always the possibility that the lift-span mechanism might freeze and close the canal to ship traffic. The only prudent course was to put the lift span in the raised position and close the bridge to highway traffic until a further study of the problem could be made.

It was apparent that removal of the earth embankment behind the abutment would relieve soil pressures on the abutment. In a few days 20,000 cu yd of earth were excavated, removing that portion of the roadway between the highway and the bridge deck itself. Although this excavation aided in stabilizing the abutment, the slide in front of the abutment continued until eventually the bottom of the footing became visible. The abutment footing finally rested on a pedestal of earth which retained its stability because of the load upon it while the earth in the immediate vicinity had either settled away or was non-effective. At this time, in March 1949, the net ground settlement which had taken place in front of the abutment in a period of several months was 12 ft.

Hurried conferences were called among the best technical personnel of the Corps of Engineers, consulting engineers and contractors, to view the situation and attempt to decide on a course of action. Collapse of the bridge appeared imminent and it was felt that any attempt at repair work which involved pile driving might give the structure the added push which would cause collapse.

Considerations Leading to Final Decision

In determining a course of action, the following factors were considered:

1. Highway traffic was suffering a loss of about $20,000 a month while the bridge was out of service.

2. An improvement program for the canal, which was being separately considered, had as one of its features the replacement of the Summit Bridge with a new high-level structure. Therefore the amount that could be justifiably spent for repairs had to be considered.

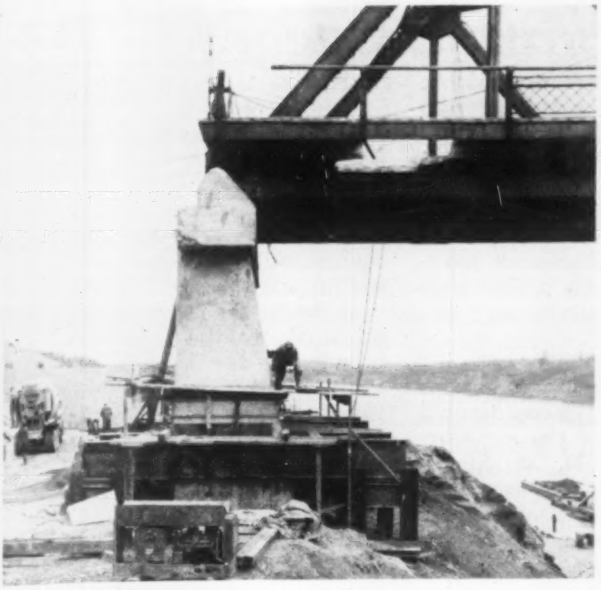
3. Collapse of the structure was imminent. If underpinning were attempted, the likelihood of causing a collapse by driving piles close to the abutment was great.

4. Collapse of the bridge would stop ship traffic and work an economic hardship on shipping interests.

The decision to underpin the abutment and risk having the bridge fall into the canal during repair operations was motivated by the following considerations:

1. Estimates indicated that the cost of dismantling the bridge in place and of removing the collapsed structure from the channel were comparable.

2. Dismantling of the bridge in place would be extremely dangerous to workmen, a consideration which in itself was sufficiently conclusive to



HOLE IN BRIDGE deck permits driving of piles on canal side. Action of pile driver caused no further settlement of abutment.

dismiss such a contemplated procedure in its entirety.

3. As only a fraction of the total repair cost was in the pile driving, no large expenditure was being risked by attempting the pile driving.

The danger inherent in the repair operation was fully realized and the first consideration was given to the safety of the working personnel and the vessels passing under the bridge. An electrical warning device was installed so that a siren would be automatically activated by any perceptible movement of the bridge abutment. As an added safeguard in the event of mechanical failure of the electrical system activating the siren, a transitman was placed so that he had a continuous sight on a wire attached to the bridge abutment; thus he could detect any movement. Workmen were only permitted on the bridge to cut holes in the deck through which the piles could be placed, and no pile driving was permitted while the cutting operation was in progress. Instructions were issued that whenever an approaching vessel reached the limit of a safe stopping distance from the bridge, the pile driving would immediately cease and not be resumed until the vessel had cleared the bridge. A "Notice to Mariners" was published explaining that the emergency repairs were to be made and cautioning pilots to be unusually alert to traffic signals as they neared the bridge.

Repair work was begun by tieing the abutment to a 4×4×40-ft concrete deadman which was poured about 50 ft north of the abutment with $1\frac{1}{4}$-in.-dia steel cables which were tightened by 2-in. eyebolts.

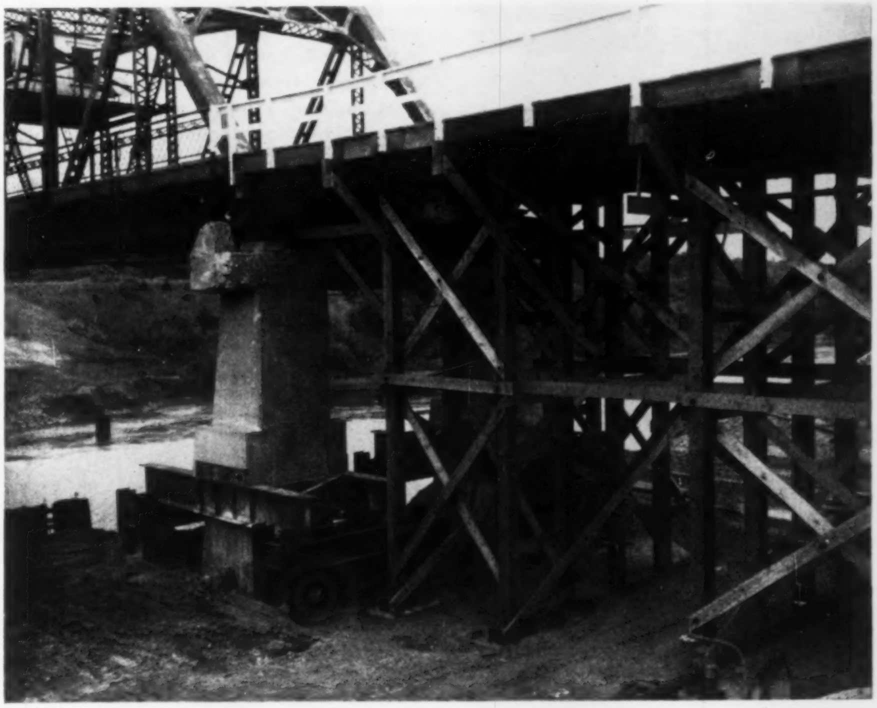
A well-point system was installed to drain off the groundwater from the area immediately surrounding the abutment as the presence of this subsurface flow was considered to be a contributing factor to the earth movement. This well-point system consisted of thirty-seven 2-in.-dia pipes with screen filters. The pipes were water-jetted into the earth 25 ft. The well points were connected to a 6-in. header pipe which in turn was connected to a 20-hp centrifugal pump.

The most precarious moments in the repair operation occurred when the H-piles were driven around the abutment. To drive the piles on the channel side of the abutment, it was first necessary to remove some of the concrete deck. A total of 16 steel H-piles, 14-in., 89-lb-per-ft, 80 ft. long, were put in place. The piles extend from El. +51.5 ft to −28.5 ft. They were driven to a bearing capacity of 60 tons as computed from the *Engineering News–Record* formula. Accurate measurements made during this operation showed no movement of the abutment.

Underpinning was designed to carry the combined dead and live load of the approach span and the dead load of the concrete abutment. The load was transferred to the steel-pile underpinning by means of a structural steel grillage. Main support members are 36-in. WF beams weighing 245 lb per lin ft. Connections to the two concrete shafts which form part of the abutment were made by notches 14 in. deep and 4 ft high cut out of the shafts and filled with reinforced concrete. The vertical load was transferred to the main support beams through the concrete poured in the transfer notches. The induced horizontal thrust in these concrete transfer notches was taken by four $2\frac{1}{4}$-in. round tie-rods. These rods were prestressed to a total load of 35,000 lb each to insure that the concrete in the transfer notches would not crack.

Approach Span Raised, Tower Straightened

With the abutment secure, the next problem was to raise the approach span about 10 in. to correct the position of the rollers in the



TIMBER TRESTLE supports 24-ft roadway and 5-ft sidewalk. Original roadway was removed when embankment was excavated to relieve soil pressure on abutment. Concrete pedestal on top of abutment corrects position of rollers and takes tilt out of north lift tower.

expansion shoes and at the same time take the tilt out of the north tower. For this purpose, six hydraulic jacks of 100-ton capacity were used. To secure adequate jacking surface, beams and plates were welded to the truss span directly over the expansion shoes. Three jacks, acting simultaneously, were used at each shoe. As the truss span was jacked up, blocks were placed in such a manner that at no time during the operation did the distance between the blocks and the span exceed 1 in. This method was used to reduce the danger of damage to the span in the event of jack failure. When the span had been jacked up sufficiently and the blocks were in place, a concrete support pedestal was poured using high early strength cement. The expansion rollers were then reinstalled and the jacks which temporarily had supported the truss-span load were removed. Thus the more hazardous operations required to make the bridge safe for highway traffic were successfully concluded.

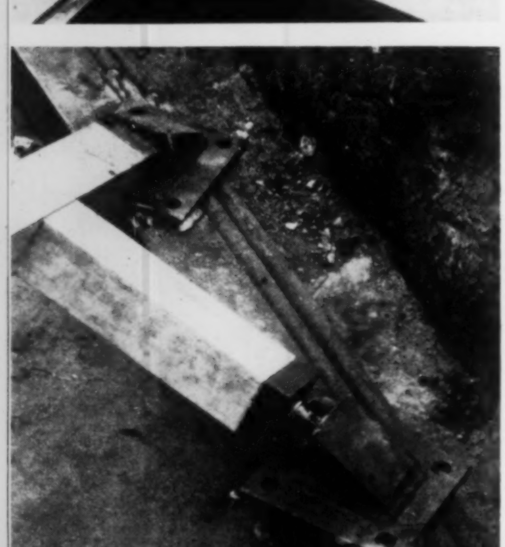
The next step toward reopening the bridge was to construct a timber approach trestle to bridge the gap created when the earth embankment north of the abutment was removed. This trestle, about 115 ft long, was constructed on timber bents founded on concrete sills. A 24-ft-wide roadway with bituminous pavement was placed with a 5-ft-wide sidewalk on the east side.

Success Due to Coordinated Efforts

The successful conclusion of this project is a tribute to the coordinated efforts and planning of the engineering forces engaged. D. M. Smallwood of the Philadelphia Office, Corps of Engineers, is to be commended for his courage and persistence in recommending that the structure be underpinned when some of the best engineering minds in the country were convinced that the bridge could not be saved. R. A. Desimone, Vice-President, and R. M. Hand, Project Engineer, of Merritt, Chapman & Scott, also deserve to be commended for the expeditious accomplishment of the pile driving, underpinning and jacking operations. Within 48 hours after they were given this assignment, Merritt, Chapman & Scott had hard-to-get steel piles, pile-driving equipment and personnel at the site prepared to begin operations.

Plans for the repair operation were prepared by the engineering staff, principally Mr. Smallwood, in the Philadelphia Office of the Corps of Engineers, with the advice of Howard, Needles, Tammen & Bergendoff. Sprague and Henwood, Inc., drilled holes through columns for tie-rods. C. B. Brown, Assoc. M. ASCE, Resident Engineer at the site, was in charge of the Corps of Engineers Forces doing the excavation, drilling and chipping out notches, and constructing the approach trestle.

Wide-Span All-Aluminum Roof Supports Brick Test Load of 27 Lb per Sq Ft



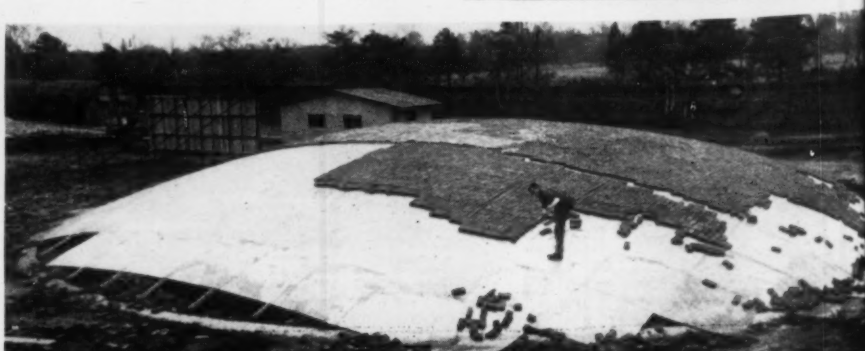
INTENDED PRIMARILY to cover oil or chemical storage tanks, a type of "self-supporting" all-aluminum roof is carried by a framework of extruded aluminum tubes measuring 2½ × 2½ in. outside and 2⅛ × 2⅛ in. inside. Curving to 100-ft radius, tubes form ribs at 5-ft intervals, tenon jointed at points of crossing.

An experimental model with a diameter of 83 ft and a rise of 9 ft was built at ground level and tested to a load of 27 lb per sq ft by covering the dome with bricks (bottom, right). Vernier readings were taken at nine points under the dome (top, right) to show vertical deflections and verify design assumptions. Ball-and-socket shoes connect rib ends with outer supporting ring (bottom, left). Aluminum sheet of 16 gage is riveted to framework by means of a template (top, left).

Designed by an English civil engineer, W. Hamilton, the roof may be welded at the joints to provide air-tightness or it may be insulated by packing insulation into rib bays, with sheeting above and below. Test loading of 120 lb per sq ft carried by 5 × 5-ft, 16-gage aluminum sheet showed ample reserve strength.

Six men can erect the framework and weld the shoes to the outer supporting ring in one day, according to the manufacturer, the Aluminum Construction Co., of London, England.

Roofs of this type are claimed to be as strong as steel and capable of spans of 500 to 600 ft.

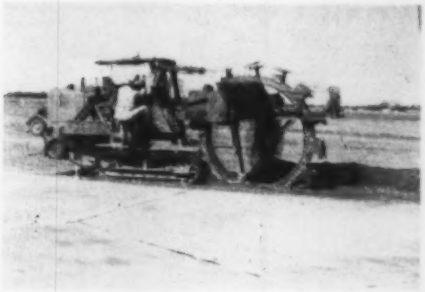


Phoenix Reconstructs Its Sky Harbor Airport

WALTER JOHANNESSEN, M. ASCE
Partner, Johannessen & Girand, Phoenix, Ariz.

MEDIUM SIZED CITIES must combine facilities for commercial planes with those for private planes. It was on this basis that expansion of the Phoenix Municipal Sky Harbor Airport was planned and is being carried out. This reconstructed airport was deliberately planned to be self-supporting and not to be a burden on the tax-paying citizens. In addition to the usual engineering facilities of a flying field, the planning engineers have included revenue producing features. Of the estimated cost of $5,000,000, the city of Phoenix will furnish $2,000,000 and the rest will be a grant from the Civil Aeronautics Administration. Sufficient revenue is needed, then, to pay operating and maintenance costs, depreciation, and interest charges on $2,000,000. Investigation showed that revenue from the flying public alone will be insufficient, and must be supplemented by other income.

Sky Harbor Airport is so close to the center of Phoenix—within $2^3/_4$ miles and 15 minutes of driving time—that a comparatively large local business area can be built up for revenue purposes. The north boundary of this area is adjacent to the main line of the Southern Pacific Railroad for a distance of $1^1/_2$ miles, and is the only undeveloped land now available for industrial purposes close to the heart of the city. Consequently this area has been set aside and zoned for industrial uses and to protect the approaches to runways.



DITCHER CUTS trench for underground utilities at Phoenix, Ariz., airfield.

Provision is being made for commercial air transport, for private flying, and for flying-service operators. In the plans ten loading positions are provided for commercial air lines and six for transient planes. The plans include provision for two large repair hangars, five flying-service operators' hangars, five hangars for commercial air lines, a parking lot for 400 cars, an automobile storage garage, an automobile service station, a fire and crash truck station complete with fire alarm and reporting system, an electrical building, two airport maintenance buildings, plane wash racks, an air-freight warehouse,

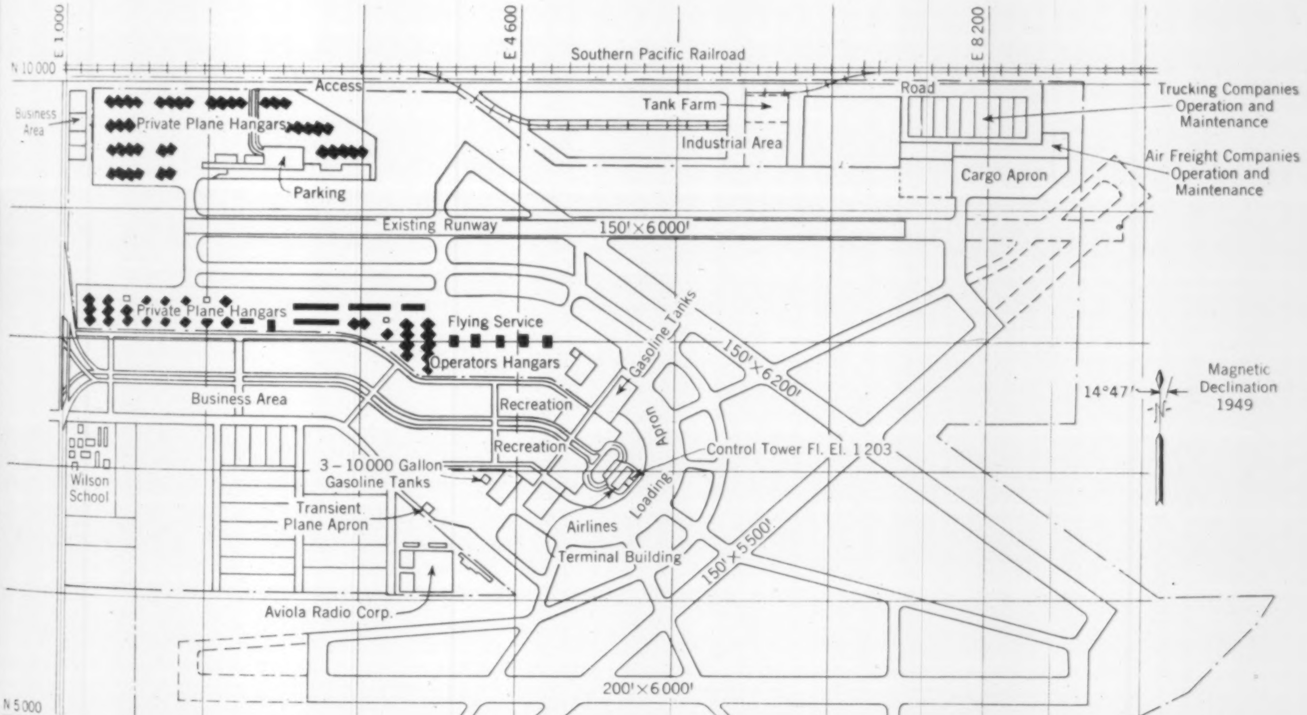
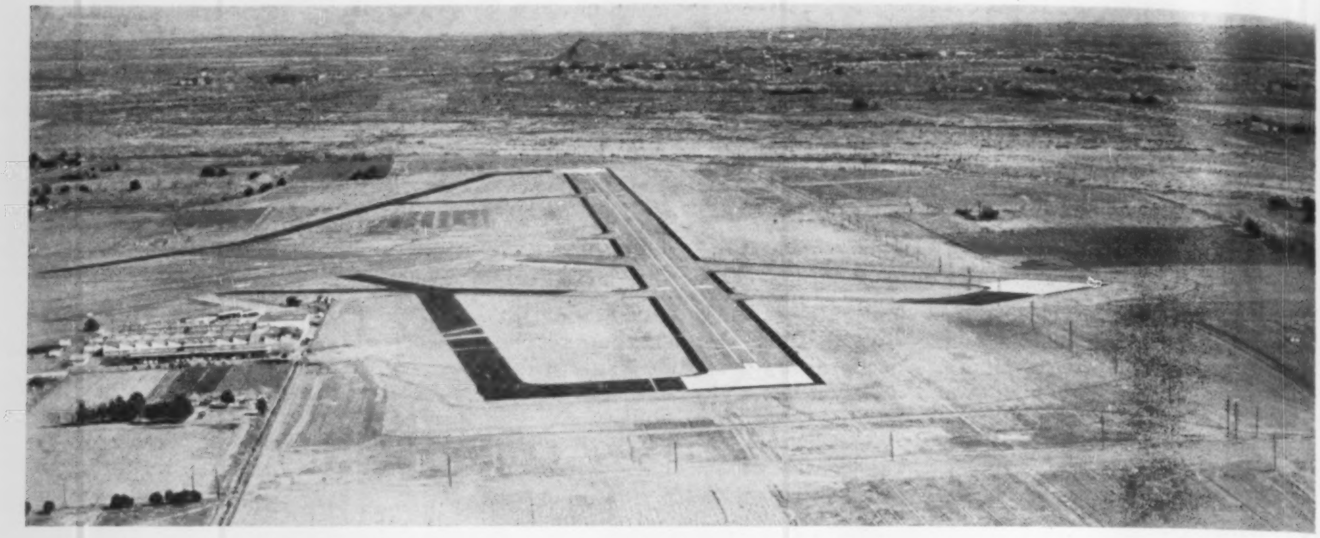

E 1 000
E 4 600
E 8 200
N 10 000
N 5 000
Southern Pacific Railroad
Access
Road
Business Area
Private Plane Hangars
Parking
Tank Farm
Industrial Area
Trucking Companies Operation and Maintenance
Air Freight Companies Operation and Maintenance
Cargo Apron
Existing Runway
150'×6000'
Private Plane Hangars
Flying Service
Operators Hangars
Gasoline Tanks
150'×6200'
Magnetic Declination 1949
14°47'
Business Area
Recreation
Recreation
Apron
Control Tower Fl. El. 1 203
3 – 10 000 Gallon Gasoline Tanks
Wilson School
Transient Plane Apron
Loading
Airlines
Terminal Building
150'×5500'
Aviola Radio Corp.
200'×6000'
Airline Hangar Apron
0
400
800
1200
Scale in Feet

FIG. 1. EXTENSION OF SKY HARBOR AIRPORT of Phoenix, Ariz., provides for growing use by private and commercial planes. Industrial and business areas are incorporated in plan to provide needed revenue.



NEW EAST-WEST asphaltic concrete runway of Phoenix, Ariz., 6,000 ft long, is designed for 120,000-lb plane loads. Ends of runways are unreinforced concrete. View looking east.

an industrial area for warehouses and small manufacturing plants, and a business area for all types of businesses, including a hotel and a motor court.

In a gasoline tank farm to be located adjacent to the railroad tracks, large tanks are to be made available for use by different gasoline companies. From these tanks three $2^1/_2$-in. gasoline lines will run to smaller underground tanks adjacent to the loading aprons. Three different grades of gasoline are provided for.

A study of the revenues derived from the present airport facilities indicates that the enlarged flying field will yield a revenue of approximately $350,000 a year from the following sources: Sale of gasoline; field-use charges such as landing fees, ramp service, rental of hangars, storage of itinerant planes, rental of small buildings, and terminal building use; rental of land for buildings in the business and industrial areas; and other miscellaneous aviation revenue. This revenue is more than enough to service the city's proportion of the airport expansion cost.

Weather Favors Small Planes

On account of the good flying weather in Arizona—the sun shines 84 percent of the time—and because of the great distances between towns, many business men use their planes instead of automobiles and trains to cover the state. A study covering 192 months of weather records showed that during only 0.002 percent of the time was the visibility less than one mile; during only $2^1/_2$ percent of the time did the wind exceed 15 mph; and in only two months did the wind exceed 39 mph.

The present field is used by 394 planes which are based there, these planes being used by contractors, commercial crop dusting and seeding firms, flying schools and private owners. In three spring months in 1947 there were 79,427 movements on the airfield, 66,650 by small planes based at the field. In a typical 24-hour day, the present airfield handles 79 commercial, 162 itinerant, and 956 locally based plane movements.

Present Use Determines New Design

A study of the use of the existing field made before the new field was designed showed that 86 percent of the flights used the existing east-west runway; 10 percent used the northwest-southeast runway; and 4 percent, the north-south runway. During high-wind conditions, the east-west runway was used 28 per cent of the time, the northwest-southeast runway 36 percent, and the north-south runway 35 percent. Although the east-west runway will be usable the greater part of the time, it was decided that diagonals would be required to make the new Sky Harbor suitable for all-weather operation since 34 of the 1,440 hours under study required the diagonals.

Movements during the peak night hour were 32; during the average night hour, 8; during the peak day hour, 254; and during the average day hour, 95. On the basis of a runway capacity of 40 movements per hour, three east-west runways would be needed. However an auxiliary field is to be built instead of the third runway since such a field, to provide for practice landings and takeoffs by student fliers, can be built for less than the third east-west runway and will clear up congested air conditions at the main field. Student use of the main field is to be restricted to initial takeoffs and final landings. As shown in Fig. 1, one new east-west runway 200 ft wide and 6,000 ft long has been completed at the main field, and the existing east-west runway will be rebuilt 150 ft wide and 6,000 ft long.

The new airport layout eliminates two of the three existing runways. Since the airport must remain in operation during the construction period, an over-all master plan of operations was developed. Drawings were made to show rerouting of existing utilities; over-all grading, turfing and sprinkling; soil analyses; pavement designs; property lines; original contours; control coordinates; runway and taxiway profiles; field drainage; runway and taxiway lighting; business, industrial and terminal areas; underground ducts for electrical and communication systems; and all pipes to carry water, gas, gasoline and sewage. With these plans and the monumented coordinates of the control survey, work can proceed in any part of the field during the four-year construction period without interrupting operation.

The land upon which the airport is being built slopes to the west toward the Salt River, with a drop of 18 ft across the field. There are no heavy cuts or fills, and little or no waste or borrow of material will be required. Runway and taxiway grades are flat, which is advantageous from the standpoint of grading but disadvantageous from that of drainage, as all drainage must be brought to an outlet into the river at the southwest corner of the field.

RUNWAY at SKY HARBOR AIRPORT, Phoenix, Ariz., is graded by caterpillar tractors and carryalls. Compaction is obtained by both sheepsfoot tampers and pneumatic-tired rollers.

Drainage is a serious problem only at rare intervals as dry desert weather prevails most of the time. The 25-year record of the U.S. Weather Bureau shows that a maximum hourly rainfall of 1.08 in. occurs once in five years. For the drainage design, the formula developed and shown in the Civil Aeronautics Administration pamphlet, *Airport Drainage*, was used, modified by making a hydraulic study of each drainage line to keep its size down by taking advantage of ponding areas. Care was taken in the study to make the drainage lines of sufficient capacity so that ponding areas would not flood into adjacent areas, which must be kept drained even during heavy rains.

Main Runways for 120,000-Lb Load

Samples of soil from 151 test holes dug over the area were tested in the Arizona Highway Department Laboratory. The findings confirmed the alluvial nature of the soil, which is composed of gravel, sand, silt, and some clay. The groundwater depth is in excess of 10 ft.

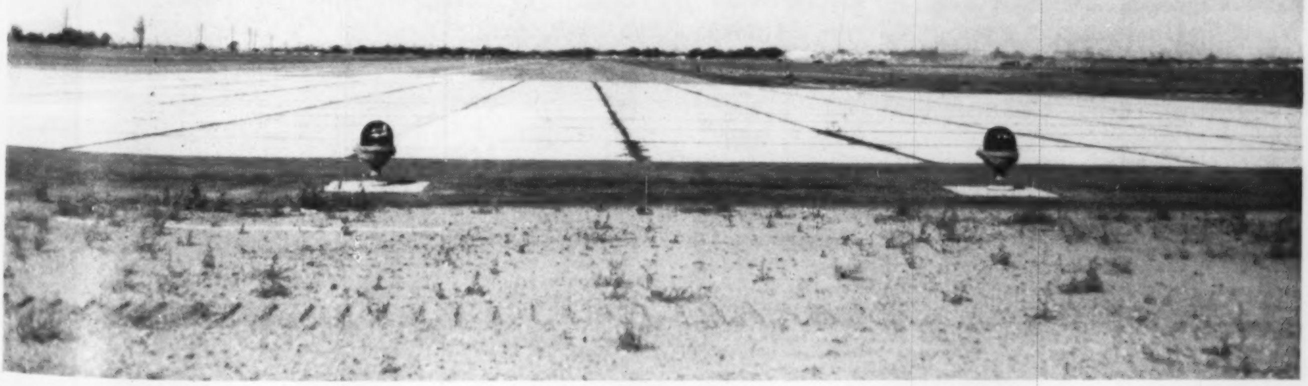
The new east-west runway, designed for 120,000-lb plane loads, will be the only runway at the airport equipped for instrument landings. Taxiways from this runway and the entire station loading apron are designed also for 120,000-lb plane loads. The pavement is composed of a 6-in. aggregate subbase, a 10-in. aggregate base course, and a 3-in. asphaltic concrete wearing surface. Because of the shearing action of planes landing on the ends of runways, and the impact of motors on warm-up pads and station apron, these areas are of 14-11-14-in. unreinforced concrete.

The two diagonal runways are designed for 74,000-lb plane loads. Because of the probable small use of these runways, thought was given to designing them for 28,000-lb plane loads. However, estimates showed that for an additional cost of $40,000 the two runways could be built for the higher plane loads, thus providing a factor of safety considered well worth the extra cost. These runways and the taxiways connecting with them are composed of a 3-in. aggregate subbase, a 9-in. aggregate base course, and a 2-in. asphaltic concrete wearing surface. The ends of these runways and their warm-up pads are of 11-9-11-in. unreinforced concrete.

Aprons for aircraft-service operators and for transient planes are designed for 28,000-lb plane loads and will be of 6-in. unreinforced concrete. Aprons for private planes will be constructed of a 6-in. aggregate base course topped with 2 in. of asphaltic concrete. All roadway pavements in the airport are to be constructed of 2 in. of asphaltic concrete on a 6-in. aggregate base course.

High-Intensity Lighting System

On the new east-west runway a complete instrument-landing lighting system will be installed, including approach lighting. The controlled-beam high-intensity lighting will be operated from the control tower. Other runways will be illuminated at night by elevated cone-type lights. Range lights will indicate the beginning and end of runways. Underground transformer vaults for the high-intensity lighting will be adjacent to the runways. Aircraft traffic lights will be installed at the ends of the taxiways to give the control tower a means of controlling planes about to enter a runway. This control is required for smaller planes, many of which have no radios.



HIGH-INTENSITY LIGHTING and facilities for instrument landings are features of new east-west runway. Ends of runway are of 14-11-14-in unreinforced concrete to resist shearing and impact action of landing planes.

Taxiways are to be lighted by cone-type lights, connected in series, and broken into circuits connected with the tower control board. This board is a small-scale reproduction of the field itself. By a push-button arrangement, the tower man can guide a plane over any desired route to the station apron.

All electric wiring will be in underground ducts, with spare ducts laid under paved areas to take care of future lighting needs not now contemplated. To insure continuity of service, two sources of electricity are available.

The airport electrical plan makes provision for serving five major needs:

1. Runway, taxiway, obstruction and guidance lighting.
2. Light and power in aircraft maintenance areas.
3. Light and power in business, commercial and industrial areas.
4. Telephone, telegraph, intercommunication, fire-alarm and reporting service for the entire airport.
5. Area flood-lighting for small planes, streets, and recreational areas.

A loop system of 6- and 8-in. water lines will be installed and connected to two sources of domestic water. Fire hydrants are to be spaced according to recommendations of the National Board of Fire Underwriters.

A sanitary sewer system, designed on the assumption that quantities will be equal to those from similar business and industrial areas in Phoenix, will connect with the municipal system.

Construction Closely Coordinated

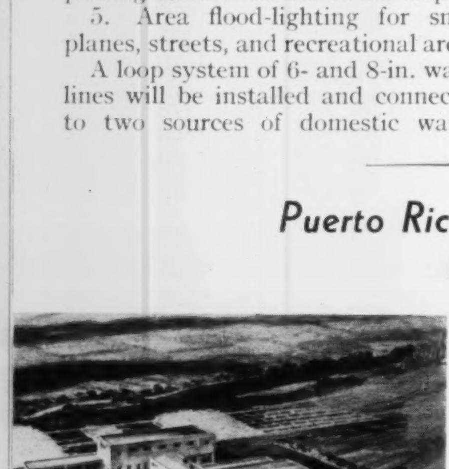
All land needed for the airport, about 1,000 acres, has been obtained and enclosed by a 6-ft chain-link fence. Irrigation ditches of the Salt River Valley Water Users Association in the area have been rerouted and high-tension electric lines moved. Close coordination between the designing and construction engineer and the airport management is necessary throughout the four-year construction period. A safety engineer handles local and day-to-day safety problems, while construction priorities are determined by conferences between the engineer and the airfield manager.

The first construction step was the building of the new east-west runway now completed, leaving all existing runways in operation. The second step, now under way, is to build the northeast-southwest runway, still leaving all existing runways in service. In the third step, a temporary control tower will be erected so that all flying activities can be transferred to the southern end of the field and onto the two new runways. Fourth, the existing east-west runway will be rebuilt and the present north-south runway abandoned. During steps one and two, while air operations are being conducted from the north end of the field, the administration building, station apron, and business-area streets are being constructed and domestic water and sanitary sewer lines installed.

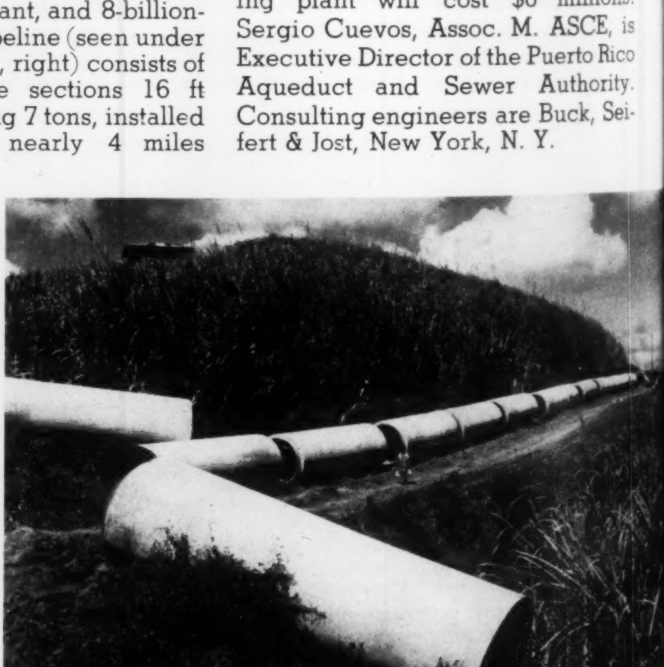
These operations require close timing in the award of contracts, with fixed time limits for the completion of each section in order to finish the airport with the least possible inconvenience to its users and in the shortest possible time for revenue purposes.

General features of the Sky Harbor Airport were determined by the Phoenix Municipal Aeronautics Commission. Officials of the Civil Aeronautics Administration assisted in the general discussions. Planning, design and supervision of construction are under the writer's direction.

Puerto Rico's 40-Million-Dollar Water Supply System Includes 8-Billion-Gallon Reservoir



FIRST PHASE of Puerto Rico's $40-million island-wide sanitation program nears completion. This Rio Grande deLoiza Project, to serve San Juan area and its 400,000 inhabitants, consists of "little-inch" pipeline, (now substantially completed), 30-mgd filtration plant, and 8-billion-gal reservoir. Pipeline (seen under construction below, right) consists of 48-in.-dia concrete sections 16 ft long, each weighing 7 tons, installed underground for nearly 4 miles through rolling cane fields to connect filtration plant and reservoir. Filtration plant (seen under construction, lower left, and in architect's drawing, left) will cover 12 acres, and with pipeline and pumping plant will cost $6 millions. Sergio Cuevos, Assoc. M. ASCE, is Executive Director of the Puerto Rico Aqueduct and Sewer Authority. Consulting engineers are Buck, Seifert & Jost, New York, N. Y.



Philippines Initiate Program of Hydroelectric Construction

FILEMON C. RODRIGUEZ, M. ASCE

Manager, National Power Corp., Manila, P.I.

FACED WITH a scarcity of coal and no commercial oil deposits—although explorations are still in progress—the Philippines have turned to hydroelectric development as a means of meeting the acute power need. Most of the larger islands include mountain areas drained by rivers with steep slopes which can be utilized for power installations. Although there are many small islands among the 7,063 which make up the commonwealth's total land area of 115,000 square miles, eleven islands have an area of more than 1,000 square miles each. A five-year program of hydroelectric development is being started this year, as here described by Mr. Rodriguez, Manager of the National Power Corp. His original paper was read before the Power Division at the ASCE Annual Meeting in New York.

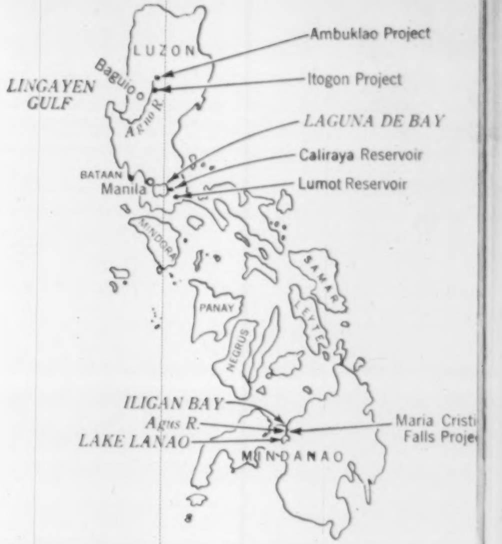
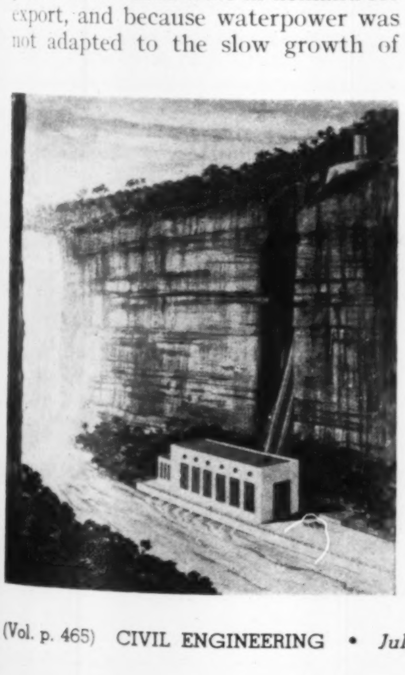


FIG. 1. FIVE-YEAR PROGRAM of Philippine Government for construction of hydroelectric plants includes eight small projects scattered throughout the Islands and three large ones—Ambuklao, Itogon, and Maria Cristina Falls. In addition, Lumot Project for damming of Lumot River waters and diversion into Caliraya Reservoir is under way.

RECENT INVESTIGATIONS have shown that the Philippine Islands are richly endowed with waterpower resources. A World Almanac estimate places the waterpower potential at about 1,500,000 hp, but this estimate could well be raised to 17 billion kwhr annually in the writer's opinion, based on a consideration of various geographical and hydrological factors. An isohyetal map shows that the rainfall varies from 27 to 131 in. yearly, of which about three-fifths falls in one-quarter of the year in the rainy season. Most of the larger islands include extensive mountain areas and the rivers have steep slopes. The country has been slow to take advantage of this rich natural resource, mainly because its economy before it attained independence was largely confined to agriculture, the products of which were in demand for export, and because waterpower was not adapted to the slow growth of local power requirements during this pioneer period. Between 1915, when the first hydroelectric plants were established, and the outbreak of the Pacific war in 1941, 26 hydroelectric plants were put in operation with a total capacity of 33,481 kw.



CHEAPEST SOURCE OF LARGE BLOCKS of power in Philippines is Lake Lanao-Agus River Basin on Mindanao, where Maria Cristina Falls Project is soon to be placed under construction. Design calls for dam located above falls to divert water to powerhouse below (shown in artist's sketch), to take full advantage of drop of 500 ft in river bed.

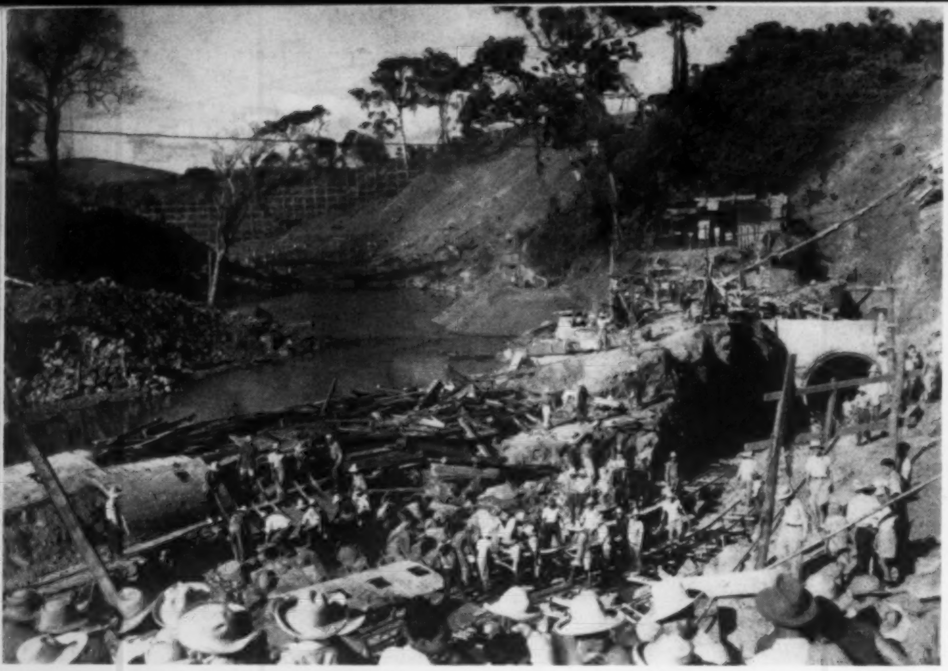
Hydroelectric Power Resources Nationalized

In the early thirties the Philippine Government realized the necessity of giving encouragement to hydroelectric power development as a requisite to the balanced growth of the national economy. By constitutional provision in 1934, the nation's power resources were nationalized and the power rights in the streams were declared to be the property of the state, which cannot be alienated. Use by private parties was limited to 25 years, extendable to another 25 years. The National Power Corporation was created to develop the nation's power resources, which were reserved for the Corporation's use, but with a provision whereby sites could be released for private use if considered unimportant or unnecessary for national development.

A power and fuel survey of the Islands made in 1937 showed an estimated total capacity of prime movers of 250,000 kw for public utilities and industries. Central-station plants furnishing power to the general public had a total capacity of 70,902 kw in 207 plants, of which 29,530, kw was generated in steam stations, 21,268 kw in diesel plants, and 20,104 kw in hydroelectric stations. These plants delivered electricity to only 349 of the 1,175 cities and municipalities of the Philippines, where there were 195,360 customers aggregating about 1,300,000 people out of the then total population of 14,-500,000.

The National Power Corporation took a liberal view of private initiative in the power generation industry in order to assure the fullest cooperation with the utilities and to take full advantage of the general effort. The Corporation adopted a policy whereby (1) it would undertake as its primary objective the development of the nation's waterpower resources to reduce the importation of fuel and at the same time increase the power supply of the country; (2) in areas covered by existing electric utility franchises, it would, in so far as possible, sell the power wholesale to the franchise holders for distribution to the ultimate consumer and would not compete in the retail power market; (3) in areas where no utility is operating, it would encourage the municipal governments to distribute the power, or encourage cooperatives or other private utilities to secure the franchise. In other words, the corporation has adopted the policy of refraining, as far as possible, from local power distribution. Rates to be charged to the general public by the distributing concerns remain subject to the supervision and control of the Public Service Commission.

From its organization in 1937 to the outbreak of the Pacific war, the National Power Corporation laid the



CALIRAYA DAM, part of first hydroelectric project to be built in Philippines by National Power Corp., and completed just before war, is located about 30 miles southeast of Manila by air distance. Earthfill structure with maximum height of 138 ft forms reservoir with usable storage capacity of 63,000 acre-ft. Construction view of dam and diversion tunnel appears above, and at left, upstream view of partially completed dam, with concrete slope paving and spillway diversion tower.

groundwork for the orderly development of the country's power resources and undertook the construction of its first hydro project, the Caliraya River Plant. This plant was placed in operation at the outbreak of the war in 1941, disabled on the eve of the Japanese occupation, operated by the Japanese, badly damaged before their withdrawal, and repaired and placed in operation by the Corporation shortly after the liberation.

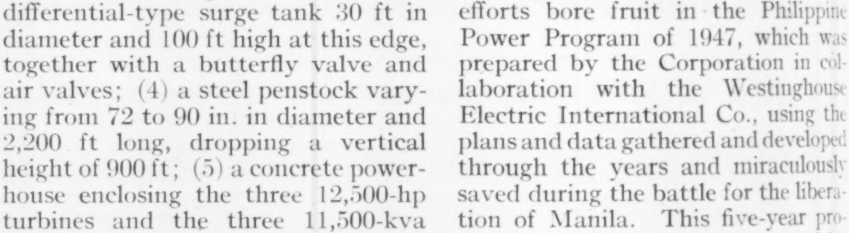
This project, up to now the largest hydroelectric plant in the Philippines, is in the province of Laguna, on the island of Luzon, about 30 miles southeast of Manila. It has an initial capacity of 27,000 kw in three units, and will have an ultimate capacity of 36,000 kw upon installation of the fourth unit. The plant consists of: (1) A large earth dam and dikes with a maximum height of 138 ft, with a usable storage capacity of 63,000 acre-ft on top of the plateau; (2) an intake and waterway in tunnel and cut-and-cover conduit 8 ft 2 in. in diameter across the plateau to the edge of the escarpment; (3) a steel differential-type surge tank 30 ft in diameter and 100 ft high at this edge, together with a butterfly valve and air valves; (4) a steel penstock varying from 72 to 90 in. in diameter and 2,200 ft long, dropping a vertical height of 900 ft; (5) a concrete powerhouse enclosing the three 12,500-hp turbines and the three 11,500-kva generators, with switchboard and control equipment. A 115-kv transmission line with step-up and step-down substations transmits the power to Manila 53 miles away.

The output of the Caliraya Plant is sold to the Manila Electric Co., a private American company holding a franchise for electric service in Manila to supplement its own hydroelectric and steam generating capacity. This power is sold under contract at $24 per kw capacity annually, plus 3 mills per kwhr of energy delivered, or an average of about 9 mills per kwhr. The rates charged were determined by agreement before the war and approximate what it would have cost the Manila Electric Co. to generate the power in a new steam station, which otherwise it would have had to construct.

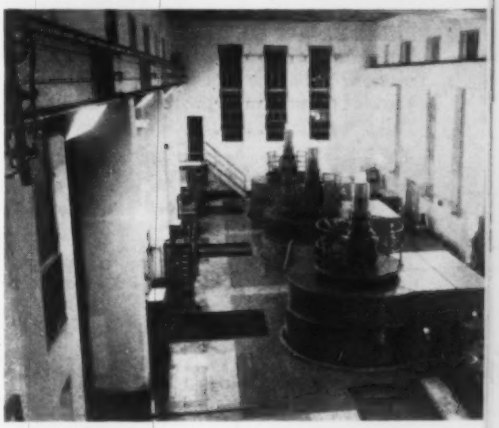
The war and three years of enemy occupation virtually wiped out all productive facilities in the islands. Most of the power generation equipment was removed, destroyed, or damaged through improper use, without care or maintenance. As late as the middle of 1946, less than 30 percent of the prewar facilities had been rehabilitated, although at that time reconstruction was moving at a fairly rapid rate—as fast as the supply of equipment and materials would permit.

Even before the liberation, the National Power Corporation saw the need for a national power program. During the dark days of the occupation, compilation of data, and preparation of plans and estimates for such a program went forward. These efforts bore fruit in the Philippine Power Program of 1947, which was prepared by the Corporation in collaboration with the Westinghouse Electric International Co., using the plans and data gathered and developed through the years and miraculously saved during the battle for the liberation of Manila. This five-year program was subsequently approved by Philippine Government authorities.

The program is planned to supplement existing hydro and steam capacity in order to meet the power requirements of the Baguio-Manila area during the next few years, with the possibility that power costs will be re-



LUMOT PROJECT, now under construction by National Power Corp. of Philippines with its own funds, diverts water from Lumot River into Caliraya Reservoir to increase power output of Caliraya Power Plant by 50,000,000 kwhr per year. Plant serves Manila and environs.



CALIRAYA HYDROELECTRIC PLANT, largest in Philippines, serves Manila and environs with 110 million kwhr annually. Powerhouse (see excavation view above and interior and exterior views at right) encloses three 12,500-hp turbines and three 11,500-kva generators, with space for fourth unit, now being installed.

duced and increased power made available for new activities. This area has the largest concentration of population in the islands and is the center of the country's light industry. It is also intended to provide a modest start in heavy industry, beginning with chemical fertilizers.

The initial phase of the program will take five years to build. It includes two projects on Luzon and one on Mindanao. One of the Luzon projects is already under construction, a diversion project from the Lumot River into the Caliraya Reservoir to provide 36,000 acre-ft of storage. The other proposed Luzon development consists of two storage reservoirs and dams with two hydroelectric plants on the Agno River—one near the headwaters at Ambuklao, with 72,000-kw capacity to be installed, and the other downstream at Itogon, with 86,000 kw capacity planned for installation—together with transmission lines and substations for the delivery of the power into the Baguio and Manila areas.

The Mindanao project is in the Agus River–Lake Lanao Basin, the cheapest source of large blocks of power in the Philippines. A number of projects have been planned for this basin, the Maria Cristina Falls Plant to be the first, with an initial capacity of 80,000 kw. The chief purpose of this installation is to supply power for a fertilizer plant capable of producing 126,000 metric tons of ammonium sulfate near the town of Iligan, since low-cost fertilizer is needed to increase the agricultural production of the country. It is expected that there will be an excess of power which will be available for the use of other industries to be established in the area, such as steel, ferro-alloy, caustic soda, aluminum and other chemical and metallurgical industries which are necessary for the balanced growth of Philippine economy.

In 1948, the National Power Corporation also adopted a small projects program which included the development of about eight minor hydroelectric sites in different parts of the country to supply local domestic requirements and small industries. The eight projects will have a total capacity of 8,000 kw, and are estimated to cost about 10,000,000 pesos. While these projects do not constitute an important power addition, they will benefit a large number of people over a wide area and will pave the way for the growth of small industries in the sections where they are located.

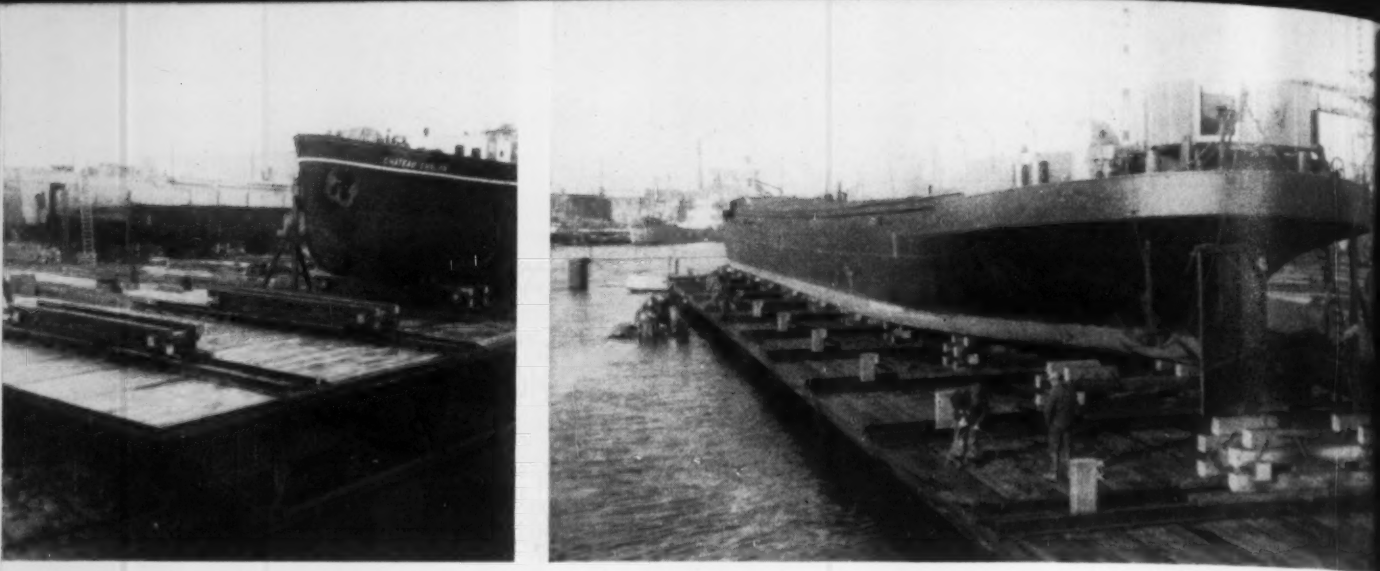
The Agno River, on which the Ambuklao and Itogon projects are to be located, rises about 35 miles north of Baguio and flows southward about 56 miles through the Benguet Mountains and thence westward to Lingayen Gulf. The drainage area down to the mouth of the canyon, where it merges into the coastal plain, is 500 sq miles. The average slope of the river is about $^7/_{10}$ percent. At the mouth of the canyon the water surface is about 325 ft above sea level, while at Ambuklao it is about 2,431 ft above sea level. There is therefore a fall of over 2,100 ft in the bed over a river length of 52 miles. The river is subject to heavy floods during the rainy season, which extends from July to December. In the dry season the flow is greatly diminished and is only about 100 cfs or less.

To provide some measure of regulation of the flow and thereby increase the year-round discharge of power generation and irrigation, it is planned to create impounding reservoirs by constructing relatively high dams at suitable locations. For the comprehensive and coordinated development of the river, some regulation of the headwaters will be necessary at the outset. The plan for this regulation includes a storage dam at Ambuklao, considered the highest practical power site on the river, and another dam downstream at Itogon, just below the junction of the Agno and Twin Rivers. Development of other sites will follow later, such as those available on the Toboy River, an adjacent stream to which the waters of the Agno can be diverted. The power output of the Agno River projects will be utilized in Baguio and Manila and the intervening area in central Luzon.

In the Agus River–Lake Lanao Basin on Mindanao, a tentative scheme has been prepared for utilizing the entire power capacity that can reasonably be developed in the basin. This scheme provides for construction of control works at the natural lake outlet to impound the water and regulate its release, and for a series of plants along the river to utilize the fall to the sea for the generation of electric energy.

The outlet works will consist of a dam across the Agus River where it issues from Lake Lanao to keep the lake at a maximum level of El. 2,300 ft, with sufficient spillway capacity to discharge the maximum flood at full reservoir without raising the lake level above this elevation. The outlet tunnel with dredged approach and discharge channels and with a gate-controlled inlet structure, will have sufficient capacity to discharge 5,650 cfs when the lake is at its lowest drawdown level at El. 2,277 ft.

(*Continued on page 82*)



RHINE BARGE ON CRADLE (above, right) awaits launching from side-haul railway drydock at Dordrecht, Holland, where it was assembled from prefabricated sections manufactured in United States and Canada. Forty-ton portal cranes used to deliver heavy forward and after sections of barges to assembly position on drydock appear in right background, and one of hauling chains can be seen in right foreground. View of other end of cradle (above, left) shows prow of another vessel, with assembly area in background.

Dutch Side-Haul Railway Drydock Speeds Assembly of Prefabricated Barges

J. STUART CRANDALL, M. ASCE

President and Chief Engineer, Crandall Dry Dock Engineers, Inc., Cambridge, Mass.

SHORTAGE OF BARGES after the war seriously reduced the transportation capacity of the canals and other waterways of France, Belgium, Holland and Germany, which normally handle much cargo. To help overcome this barge shortage, the French Government, through the Office National de la Navigation and the French Mission of Public Works in Washington, D.C., engaged George E. Sharp to design self-propelled barges, which were constructed by Ingalls Shipbuilding Corp., Birmingham, Ala., Victoria Machinery Depot, Victoria, B.C., Dominion Bridge Co., Vancouver, B.C., and others, for shipment in prefabricated sections to Dordrecht, Holland, where Ateliers et Chantiers de Biesbosch, a French affiliate, was to assemble these craft. To provide assembly facilities on a production-line basis, a 300-ton side-haul railway drydock of unique design, with a transfer system, was installed.

Assembly-Line Procedure Planned

The de Biesbosch shipyard is on a peninsula between the Merwede and the Wanty. The site for the assembly area abuts on these two streams. The problem involved providing means and space for unloading and storing the lighter sections and equipment, for lifting and placing

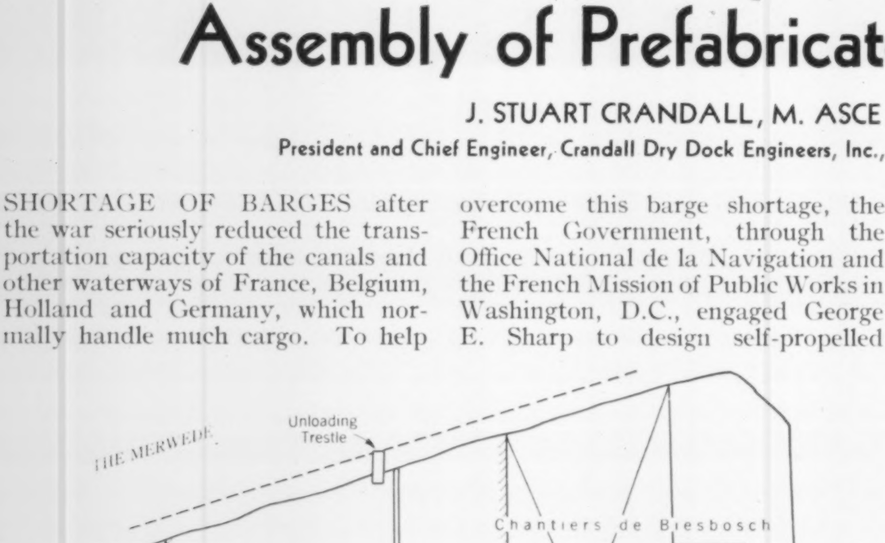


FIG. 1. PLANT FOR ASSEMBLY of prefabricated self-propelled barges has strategic location on peninsula between Merwede and Wanty Rivers, at Dordrecht, Holland, yards of the de Biesbosch Company. Two 40-ton portal cranes running along edge of lighter basin pick up 80-ton after sections of barges from lighters and transport them on tracks directly to back section of drydock where initial assembly is made. Smaller pieces are picked up from lighters on Merwede River side by 15-ton caterpiller crane and delivered to storage area and thence to assembly position on drydock.

the heavy after sections weighing 80 tons, for assembling the barges and for their eventual launching.

A short trestle was constructed facing the Merwede River to permit a 15-ton crawler-type crane to unload the smaller pieces directly from lighters, store them in the adjacent area, and ultimately deliver them to the assembly line. Two traveling 40-ton portal cranes were installed at the rear of the assembly area with tracks extending over the lighter berth on the Wanty to permit lifting the heavy forward and after sections directly from the lighters to the assembly point. The side-haul railway drydock was constructed on the bank of the Wanty, with horizontal transfer tracks running back into the construction area, providing space for three barges on the assembly line (Fig. 1).

Design Permits Accurate Calculation of Load

Side-haul railways have usually consisted of several cradles each hauled by one or two chains or wire ropes. Inasmuch as uniform movement of this series of chains or ropes cannot be obtained and an equalizing system is fundamentally impossible, the actual loads on the various parts are indeterminate and some of the parts are frequently overloaded. The Dordrecht drydock presents a unique solution to this problem. It consists of a single cradle on multiple tracks operated by only two hauling chains with the result that the load on each chain can be accurately calculated for any given location of the center of gravity of the superimposed vessel, the differential movement of the two chains having no effect on the chain loads.

General dimensions of the drydock are approximately as follows:

Length over blocks . . .	256	ft
Length over deck . . .	279	ft
Width over deck	42½	ft
Water over blocks . . .	5	ft

THREE - HUNDRED-TON side-haul railway drydock docks Rhine barge. Truck wheels attached to each lower chord of cradle run on twelve rails. On wood deck of cradle, 24 horizontal transfer tracks arranged in pairs are continuous with tracks on stationary section of drydock.

The steel cradle consists of twelve runners, each composed of a sloping lower chord and a horizontal top chord, the chords meeting at their inner ends and being connected by vertical columns as they diverge, forming wedge-shaped Vierendeel trusses (Fig. 2). Twelve truck wheels are attached to the bottom of each lower chord. These runners are connected together by beams in the plane of the top chords and by a truss in the plane of the lower chords, the truss acting to transfer the slope component of the load, vessel and cradle to the two hauling points where the chains are attached. The top of the cradle is equipped with 24 horizontal transfer tracks arranged in pairs, the tracks of each pair being one meter apart and axial with each cradle runner. The entire cradle has a wood deck for a working platform.

A retaining headwall of reinforced concrete supported on wood piling extends the full length of the cradle at the upper end of the tracks, acting to retain the sand fill of the assembly area. The transfer tracks are supported on reinforced concrete slabs resting on the natural sand and consolidated sand fill, each slab carrying a pair of transfer tracks extending about 121 ft into the assembly area perpendicular to the Wanty. These tracks correspond to those on the cradle.

The cradle moves over six two-way tracks of wood about 117 ft long, constructed on a gradient of 1:5. These tracks are of three-tier construction with a heavy crane-type rail fastened to the top of each way. The tracks are supported by wood piling cut off along the slope. Each track was constructed as a unit on shore, floated into position, sunk in place, carefully aligned and then fastened to the piling.

Hauling of the cradle is accomplished by two alloy cast-steel chains, each arranged on an endless system with smaller connecting chains of wrought iron. Each hauling chain passes around a toothed chain wheel on the main shaft of a unit of the hauling machine. These two units, consisting of a train of steel gears, are spaced about 138 ft apart and connected by a line shaft to a 60-hp electric motor capable of drydocking a capacity load in 15 minutes.

Prefabricated sections of barges are assembled on wood transfer cradles along the axis of the portal cranes. These cranes lift the after sections directly into position from the lighters and place the other sections as delivered by the crawler-type crane from the storage area. Following initial assembly, a barge is moved on rollers along the transfer tracks to the next berth for further assembly and fitting, and a second

(*Continued on page 82*)

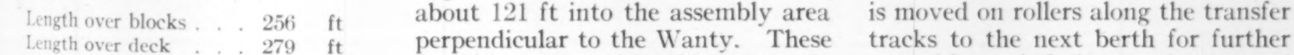


FIG. 2. **SIDE-HAUL RAILWAY DRYDOCK consists of three berths for assembly of prefabricated barges and single steel launching cradle** which runs **on multiple tracks and is operated by two hauling chains. See Fig. 1 for location of cross section. Steel cradle consists of** twelve runners **each composed of sloping lower chord and horizontal top chord connected by columns to form wedge-shaped Vierendeel** truss. Cradle **has wood-deck working platform.**

Milwaukee Takes Long-Range View of Urban Highway Needs

CHARLES E. DeLEUW, M. ASCE and
WILLIAM R. McCONOCHIE, Assoc. M. ASCE

Respectively President and Chief, Traffic and Transportation Section, DeLeuw, Cather & Co.,
Consulting Engineers, Chicago, Ill.

A TWENTY-FIVE-YEAR PROGRAM for the construction of an expressway system to cost $129,000,000, and for major street improvements to cost $15,000,000, has recently been submitted to the Mayor and Common Council of Milwaukee and the State Highway Commission of Wisconsin. The first stage of construction has already been approved by the Board of Public Land Commissioners.

Two administrative procedures distinguished the advance planning of this program from the numerous urban transportation studies conducted since the end of the war. First, the work of the consulting engineers, De Leuw, Cather & Co., was reviewed almost weekly by a committee representing the major official bodies at interest. The planning aspects of highways and of all other land uses in both the city and the surrounding county were considered, as were the financial, construction, maintenance, operations, safety and policing phases. Members of municipal departments attended committee meetings when problems relating to their departments were to be considered. Second, newspaper reporters were present at all discussions with the consultants so that the public had a behind-the-scenes view of techniques and procedures as the program evolved. Both policies have proved sound in that confidence and understanding have been engendered in both official and unofficial circles.

Need for Expressways Demonstrated

One of the first steps was to investigate the adequacy of the present street system for 1960 traffic volumes. This study was based on a report on "Highway Capacity" which will soon be published by the Highway Research Board. The report is the result of several years of work by a committee headed by O. K. Normann of the Public Roads Administration. Investigations at over 200 widely scattered street intersections indicated that congestion in rush hours will be intolerable by 1960 unless bold steps are taken to provide additional traffic capacity. This conclusion was dramatically verified by a one-day strike of bus and street-car operators in January 1949. The entire city became almost paralyzed in the evening rush hour on that day because of the added number of private vehicles on the streets. The 24-hour traffic at three key points was only 21 percent above that of January 1948, while it is predicted that 1960 traffic will be approximately 23 percent greater.

Experience in other cities has proved that the most economical way to obtain added traffic capacity to the extent needed in Milwaukee is through the construction of expressways. Improvements to the major street system such as widening, channelization and grade separations must continue, however, since traffic volumes will increase in almost the same amount that added capacity can be provided through expressways. The intent, therefore, is not to supplant the existing streets, but rather to keep abreast of traffic with a comprehensive improvement program covering all types of traffic arteries.

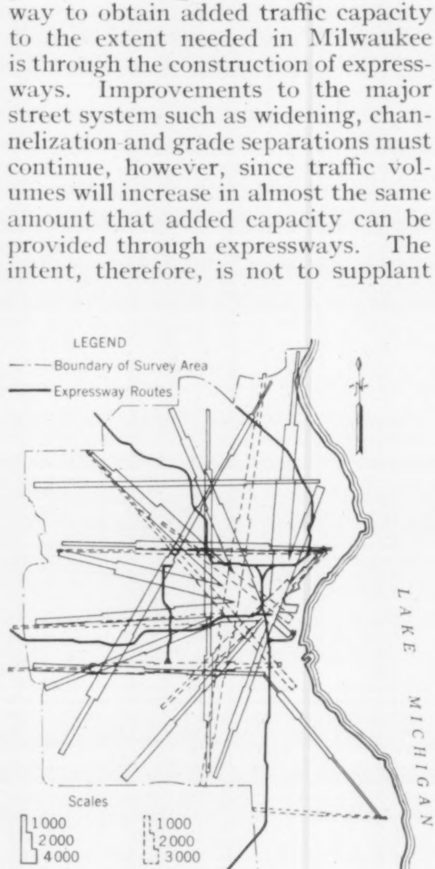


FIG. 1. TRUCK AND AUTO TRAFFIC distribution in Milwaukee forms radial pattern, as determined by transportation study. Heavy line indicates proposed routes. System of expressways 31 miles long will connect with state trunk highways and will be supplemented by network of major streets.

A 31-mile system of expressways was recommended which would consist of a central trunk with four branches to the northwest, northeast, south and west sectors of the metropolitan area. (See Fig. 1). All the routes would connect with state trunk highways, but the primary purpose of the expressways would be to serve people living and working within the metropolitan area. The south and west expressways, together with a portion of the central trunk, would include parts of the proposed 40,000-mile network of interstate highways connecting all major cities in the United States.

Estimates of future traffic on the recommended system of expressways indicate that traffic will be attracted in volumes justifying this superior type of highway. A study in time savings which will be realized by the users of the highways indicates that 70 man-years of time otherwise wasted in congested traffic will be saved by the expressways every 15 days. It is contemplated that express bus service will be operated on the expressways so that users of public transportation in all parts of the metropolitan area will share in the benefits afforded by the new highways.

Major Street System Chosen

A major street system has been selected to supplement the recommended expressways. This network of major streets is composed of existing thoroughfares which are to be improved to correct lack of continuity, offsets in alignment or inadequate capacity.

The major streets will serve as collectors and distributors of expressway traffic, and as traffic arteries in areas where expressways cannot be justified. It is the recommendation of the consultants that the major streets be improved gradually through the application of proved techniques, including lighting, signalization, channelization and one-way operation, as required. In addition, these streets should be given priority in repairs, snow removal and other maintenance.

Truck terminals at the outer limits of the metropolitan area will permit the transfer of a large tonnage of general freight from over-the-road trucks to smaller route trucks for distribution within the city. Three sites have been suggested which are properly located in relation to railroads, existing highways, and the future expressways. Economic studies will be required to determine the extent to which such terminals should be built.

Parking facilities for Milwaukee are being planned by the Mayor's Interim Parking Commission. Many studies conducted during the preparation of highway plans will be of value to this commission, including the consultants' inventory of both curb and off-street parking facilities in the central business district.

Cost and Financing of System

The cost of the entire expressway system, major connections and interurban railroad betterments will be $129,425,000, of which $3,275,000 is required for the relocation of privately owned utilities. It may be found that a portion, or all, of the latter item is a legal obligation of the utility companies.

Economic justification for the expenditure of these substantial sums was established by the firm of Parsons, Brinckerhoff, Hall & Macdonald of New York as a corollary study. It was found that the user benefits during the life of the expressway system would average approximately $9,150,000 per year, or 2.19 times the estimated annual costs of providing the facilities, including an allowance for interest on the investment. In addition to these benefits there would be other gains, which would be somewhat intangible but nonetheless real. Such advantages would include increases in the value of adjoining lands, stabilization of property values in commercial and industrial areas and other items of vital importance to the economic welfare of the entire community.

A 25-year construction program will require an outlay of approximately $5,000,000 per year. Of this amount, $1,330,000 will be required from the City of Milwaukee and an additional $170,000 from other local governmental units, based on formulas developed for the distribution of funds made available by the 1944 and 1948 Federal Aid Act and supplemental state legislation. The remaining $3,500,000 will come from Federal Aid Funds and funds of the State Highway Commission.

Accumulated federal and state funds which could be applied to the expressway system are sufficient for the first one and one-half or two years. Local funds from the $5,000,000 bond issue approved by the voters of Milwaukee in 1948 are available to initiate the program. It is reasonable to assume that federal and state aid will continue since imposts on highway users exceed expenditures for highways by a substantial margin.

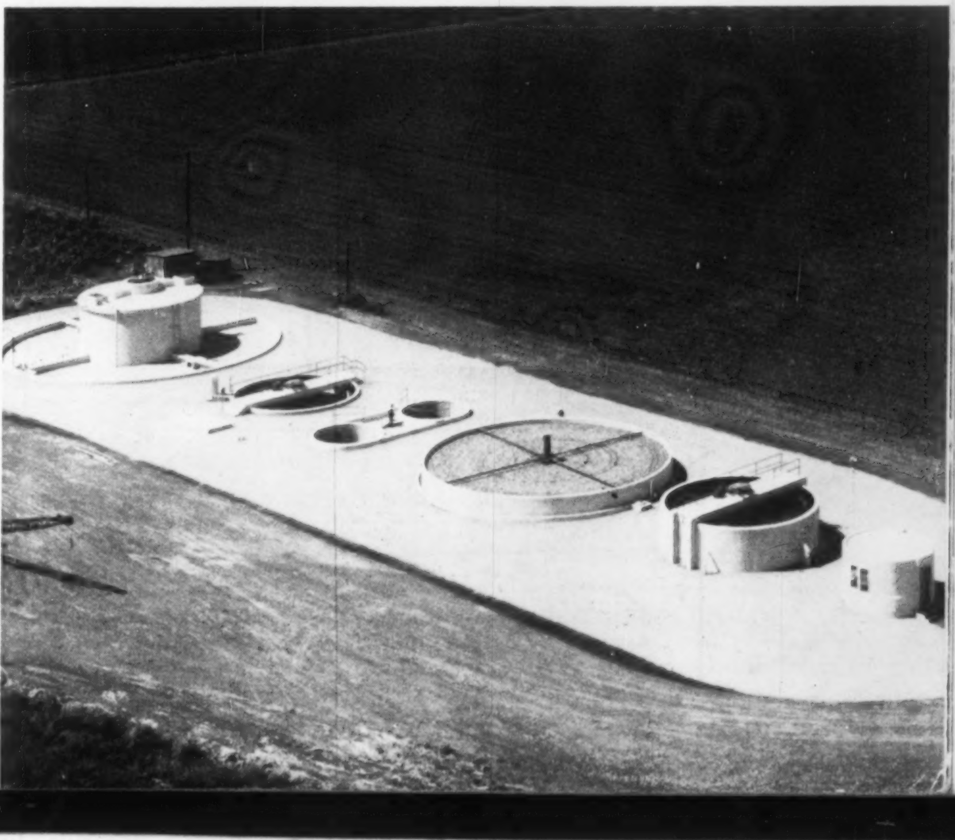
A program has been outlined for the stage construction of the entire expressway system. Priority has been established by studies of economic justification, and by such practical considerations as the housing shortage, the adequacy of existing surface streets and coordination with other civic improvement projects.

The urgent need of finding a solution to the problem of handling Milwaukee's traffic expeditiously is demonstrated daily. A clear-cut program for the solution of this problem is presented in the recent report of the writers' firm. The program appears to be well within the financial ability of the community with the aid of anticipated federal and state funds. There is every evidence that the necessary leadership will develop to carry these plans into action.

Streamlined Sewage Treatment Plant Completed in Five Months in Monterey County, California

BUILT AT A COST of about $150,000, the new sewage disposal plant of the city of Castroville, in Monterey County, California, has a design capacity of 300,000 gpd and will serve a present population of 1,200 and an ultimate population of 3,000. The elements of this streamlined plant, which seen from the air has somewhat the appearance of a ship's deck, appear in the accompanying photograph. Beginning at the right, they are: Control house structure, primary clarifier, bio-filter, two aeration tanks, final clarifier, and sludge digester with drying beds beyond. Special features of the plant are the sludge handling equipment, aerator units and recirculation facilities provided.

Design of the plant was by Harry N. Jenks, M. ASCE, consulting sanitary engineer, and construction was rushed to completion ahead of the contract schedule by Clyde K. Moseman, partner in the firm of Charles MacClosky Co. of San Francisco, contractor. Construction was started in the fall of 1948 and the plant was finished in April 1949. Howard F. Cozzens, M. ASCE, Monterey County Engineer, had over-all supervision of the sewage treatment project.



Construction Starts on Prestressed Concrete Bridge in Philadelphia

First Bridge of Its Type in United States Involves Tests to Failure

E. R. SCHOFIELD, M. ASCE

Principal Assistant Engineer, Bureau of Engineering, Surveys and Zoning, City of Philadelphia, Pa.

GROUND WAS BROKEN on April 20 for a prestressed concrete deck-girder bridge over Lincoln Drive at Walnut Lane in Fairmont Park, Philadelphia—the first such bridge to be constructed in the United States. The design follows that developed in Belgium by Prof. Gustav Magnel, M. ASCE, of the University of Ghent. The bridge consists of a 160-ft central span flanked at each approach by a 74-ft span (Fig. 1). It is designed for H-20-44 loading, and additional impact of 17 percent. The 44-ft roadway is to be surfaced with asphalt plank. One each side of the roadway 9-ft sidewalk is provided.

Saving of 30 Percent in Cost

The lowest acceptable bid received at the opening on January 19, was that of the Henry W. Horst Co. for \$698,383; the next bid was that of The Conduit and Foundation Corp., \$705,706.50; and the next that of Frank Mark Co. for \$715,305. The engineer's estimate was \$775,000. Before comparing the low bid of \$698,383 for the prestressed bridge with that received in October 1947, in the amount of \$1,047,789.75 for a stone-faced arch bridge at the same location, the 1947 figure should be adjusted upward to \$1,250,000 to include the increase in cost of such structures since that date, and then reduced by about \$200,000, the cost of the stone masonry facing on the arch bridge, which is omitted from the prestressed design. These calculations show a net comparable saving of about \$300,000.

Foundation conditions at the Walnut Lane site are not good. For an arch, 35 ft of excavation would be required, and it would be expensive to provide for the horizontal components of the arch thrust. Although the site is obviously unsuited for an arch, the Art Jury of the City of Philadelphia, which must approve all structures built with city funds, declined to consider plans for a steel girder bridge until the writer proposed a prestressed concrete girder design.

Early designs for a prestressed bridge at the Walnut Lane site were based on a continuous-span box-girder type of structure using Roebling cables as the prestressing steel. This design, in which the cast-in-place box-girders made up the full length and width of the bridge, precluded the testing of any essential element to failure, a procedure which the writer considers important, both for its educational value to the profession and as a safeguard to the city against unforeseen errors in design.

Coincident with these studies, The Preload Corporation, which was building several prestressed concrete sludge digestion tanks under the writer's supervision, retained Professor Magnel to develop the design which was adopted and is now under construction. There are 13 precast flanged girders 6 ft 7 in. deep in the central span, and seven similar girders in each side span (Fig. 3).

Instead of cables, as in the box-girder type, the design adopted utilizes single-strand prestressing wires, which like the cables are manufactured by the John A. Roebling's Sons Co. Wires are 0.276 in. in diameter, and have an ultimate tensile strength of 210,000 psi, with a yield strength of 160,000 psi at 0.2 percent permanent set. The wires will be prestressed to 125,000 psi, and the final stress, after shrinkage and plastic flow of the concrete and creep of the steel have taken place, will be about 105,000 psi. Concrete is specified to have a 28-day crushing strength of 5,400 psi. Initial prestressing of the concrete will be to a maximum of 2,000 psi, but some reduction will occur, making the working stress about 1,800 psi. On the assumption that there will be a gain of 30 percent in the strength of the concrete before the bridge is opened for service, the factor of safety is about 4, the usual figure in conventional concrete design.

Prestressed and Conventional Beams Compared

Prestressed concrete for bridges should be considered as an alternative to the conventionally reinforced type of concrete structure, and will prove more economical. The comparative wastefulness of the conventional design is demonstrated as follows.

In a conventionally designed reinforced concrete beam, the resisting moment per unit of width with respect to the concrete, M_c, is equal to the resultant of the compressive forces in the concrete multiplied by the lever arm between this resultant and the resultant of the tensile forces in the steel. The total compressive force in the concrete is represented by the area of a triangle which has as its base the top fiber stress, f_c, and as its height $^{3}/_{8}d$, where d is the

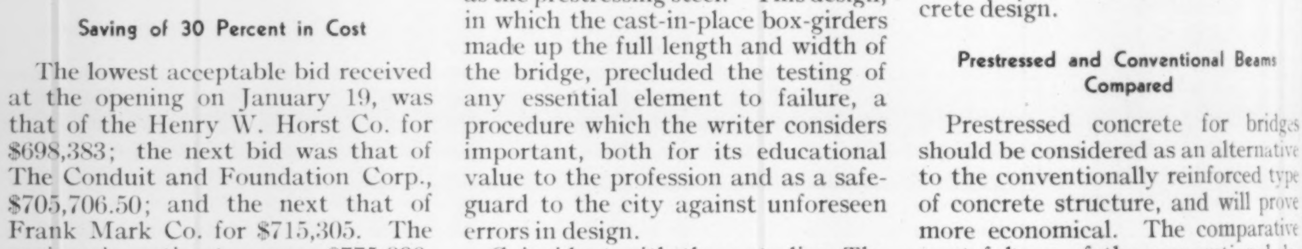


FIG. 1. WALNUT LANE BRIDGE, under construction in Philadelphia, incorporates long-span prestressed concrete girders thus introducing design new to United States.

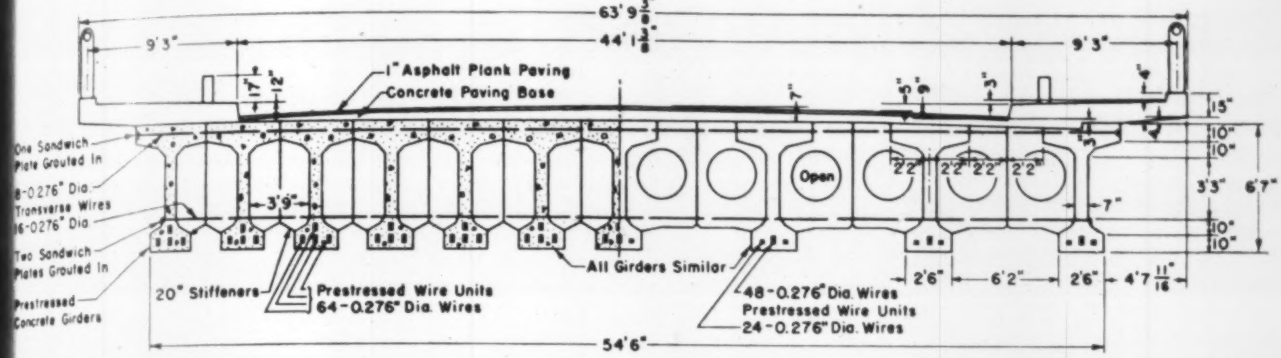

63'9 3/8"
9'3"
44'1 3/8"
9'3"
1" Asphalt Plank Paving
Concrete Paving Base
One Sandwich Plate Grouted In
8-0.276" Dia. Transverse Wires
16-0.276" Dia.
Two Sandwich Plates Grouted In
Prestressed Concrete Girders
3'9"
Open
2'2"
2'2"
2'2"
2'2"
7"
15"
10"
10"
3'3"
6'7"
10"
10"
20" Stiffeners
Prestressed Wire Units 64-0.276" Dia. Wires
All Girders Similar
48-0.276" Dia. Wires
Prestressed Wire Units
24-0.276" Dia. Wires
2'6"
6'2"
2'6"
4'7 11/16"
54'6"

FIG. 3. SPANS CONSIST of identical prestressed girders 6 ft 7 in. deep, weighing 150 tons each. Girders are cast separately, then tied together in place by high-strength wires. Main-span girders are spaced as shown at left of center line. Spacing of approach-span girders is shown at right of center line.

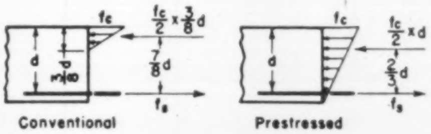

f_c
$\frac{f_c}{2} \times \frac{3}{8}d$
$\frac{7}{8}d$
d
$\frac{3}{8}d$
f_s
Conventional
f_c
$\frac{f_c}{2} \times d$
$\frac{2}{3}d$
d
f_s
Prestressed

FIG. 2. DESIGN OF PRESTRESSED BEAM shows no tension in concrete.

effective depth of the beam. The lever arm is $^7/_8 d$ (Fig. 2).

$$\text{Therefore } M_c = \frac{f_c}{2} \times {}^3/_8\, d \times {}^7/_8\, d$$

$$= \frac{21}{128} f_c d^2 = \frac{1}{6}\, d^2$$

approx.) for conventional design.

In a prestressed beam the concrete fibers are put in compression before any load is imposed, the amount of the prestressing being determined by the amount of live load and dead load to be carried, so that no fiber in the cross section is in tension. By this means the resisting moment characteristics of the beam are changed so that the total compressive force in the concrete is represented approximately by a triangle with a base of f'_c and a height of d. For this beam, the resisting moment with respect to the concrete is

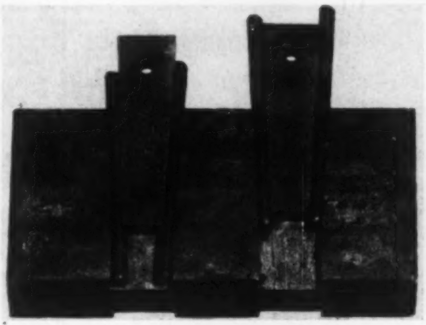
$$M_c = \frac{f'_c}{2} \times d \times {}^2/_3\, d = \frac{1}{3} f'_c d^2$$

which is about twice that of the conventional beam. Moreover, the permissible unit stress in a prestressed beam can be greater than that used in conventional design. In the design of the Walnut Lane Bridge a value for of 1,800 psi was used instead of the conventional f_c value of 900 psi.

These figures indicate that a prestressed beam is approximately four times as strong as a conventional beam of the same depth and cross section.

In the design of ordinary concrete it is customary to use compressive concrete stresses of about 900 to 1,000 psi and steel stresses of about 18,000 or 20,000 psi.

To replace ordinary concrete with high-compressive-strength concrete now available up to 10,000 psi causes a problem, since it reduces the cross section of the beam to such an extent that there is not room for the excessive amount of mild steel reinforcement required. To replace the mild steel reinforcing with high-yield-strength steel would permit a reduction in area of the steel, which sets up another problem. Concrete has little or no strength in tension, which means that the reinforcing steel must take up design tensile stresses. The concrete surrounding the steel and bonded to it can elongate only up to its tensile limit or it will crack.



SANDWICH PLATES $1\frac{1}{2} \times 3\frac{1}{2} \times 6$ in. rest on edge against bearing plate at ends of girder. Hydraulic jack applies predetermined load to each pair of prestressing wires, which are wedged in slots of sandwich plate and grouted in. Each sandwich plate carried four pairs of wires, two pair on upper side and two pair on under side.

In the conventional reinforced beam, using mild steel with a yield strength of 33,000 psi, the concrete cannot follow the elongation of the steel under load, and cracks develop. Use of high-yield-strength steel, now available up to 160,000 psi, would reduce the area of the steel to about one-fifth of that otherwise needed, but elongation of the steel would be increased five times, and the width of the cracks in the concrete would increase a like amount. For these reasons it has been impossible, with ordinary concrete design, to realize fully the advantages that should be obtained in reinforced concrete structures by the use of high-strength concrete and high-strength reinforcing steel.

Prestressing is a method that was developed to make available to the designer and builder those high qualities of materials which modern industry has developed in recent years. Further, the concrete beam, now in compression, thus realizes its full load-carrying potential. This result is achieved by applying tension to the unbonded steel-wire reinforcing be-

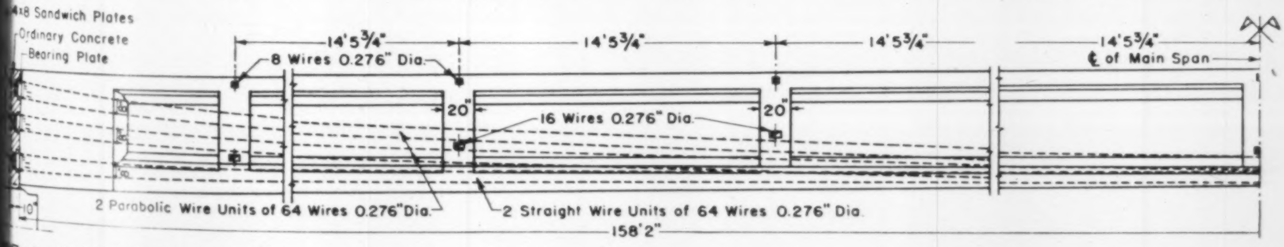

4x8 Sandwich Plates
Ordinary Concrete
Bearing Plate
14'5 3/4"
14'5 3/4"
14'5 3/4"
14'5 3/4"
℄ of Main Span
8 Wires 0.276" Dia.
20"
16 Wires 0.276" Dia.
20"
10"
2 Parabolic Wire Units of 64 Wires 0.276" Dia.
2 Straight Wire Units of 64 Wires 0.276" Dia.
158'2"

FIG. 4. PRESTRESSING WIRE units inside their metal sheaths are concreted in as girder is poured. Before scaffolding and forms are removed, wires passing through sandwich plates are prestressed to 125,000 psi, wedges are driven and grouted in.

fore the girder carries the load in such a way that the concrete, when loaded, remains in compression at every cross section under all combinations of dead and live load (Fig. 2). Because of the high initial stress in the cold-drawn wire reinforcing, the variation of stress in the steel, and consequently its elongation, rarely exceeds 4 percent. In this manner high strengths in both steel and concrete are utilized. Prestressed concrete has other advantages which are not detailed here. Credit for the development of this method of design and for improvements in concrete strengths belong to the eminent French engineer, Eugène Freyssinet.

Construction Procedure Requires Planning

Each 160-ft girder in the Walnut Lane Bridge will weigh 150 tons, which presents a serious transportation and placement problem should the girders be cast at a distance from the site. During the design stage this possibility was contemplated and many hoisting rigs were designed and considered. The contractor has elected to cast the girders on top of the 50-ft piers, one or two at a time, using falsework to support the forms.

Before concreting, the wires for the longitudinal prestressing will be placed in units in the bottom flange of the girder forms, four units in the 160-ft central girders and three in the side spans (Fig. 4). The arrangement and position of the wires are predetermined so that the prestressing force will act with its greatest eccentricity at the center of the span where the moment is greatest, and will decrease to zero eccentricity at the supports. The four wire units in the main span contain 64 wires each, a total of 15.3 sq in. of steel; in the side spans two units contain 24 wires and one 48 wires, a total of 5.8 sq in. of steel. Each unit is enclosed in a sectional steel sheath about $2^1/_2$ by 8 in. in cross section.

Wires in a unit are positioned in their sheaths by mild-steel spacers located at intervals so that the wires are nowhere closer than $^3/_{16}$ in. to each other or to the inside surface of the sheath. In the main span, two sheaths containing wire units are set in the forms horizontally, and two sheaths curve upward from the low center position along a predetermined rising parabola to extend beyond the ends of the girder. In the side spans only the 48-wire unit is curved upward from the center of the span.

After the concrete in a girder is poured, the wires are prestressed in pairs by specially designed hydraulic jacks. Each pair of wires is fitted into a tapered slot in a flat steel locking device known as a sandwich plate. Each $1^1/_2 \times 3^1/_2 \times 6$-in. sandwich plate holds four pairs of wires and rests on edge against a distributing plate bearing on the concrete at the end of the girder. After the wires are stressed, flat steel wedges are driven into the slots to lock one wire against each side of the slot. Thus any pressure exerted against one wire of a pair reacts on the other with equal locking pressure. In addition to the mechanical lock of the wedges in the sandwich plates, the wires are bonded together by grout, which is forced into the wire sheaths until they are filled. After prestressing, the end bearing plates and the sandwich plates and their wedges are grouted in to protect them from the weather.

On completion, each girder will be moved laterally into final position on the piers. When all the girders are in place they will be pulled together laterally by transverse prestressed wire units running through the top and bottom of the diaphragms, and spaced about 14 ft 6 in. apart in the main span and 16 ft apart in the side spans. Wires will be grouted in.

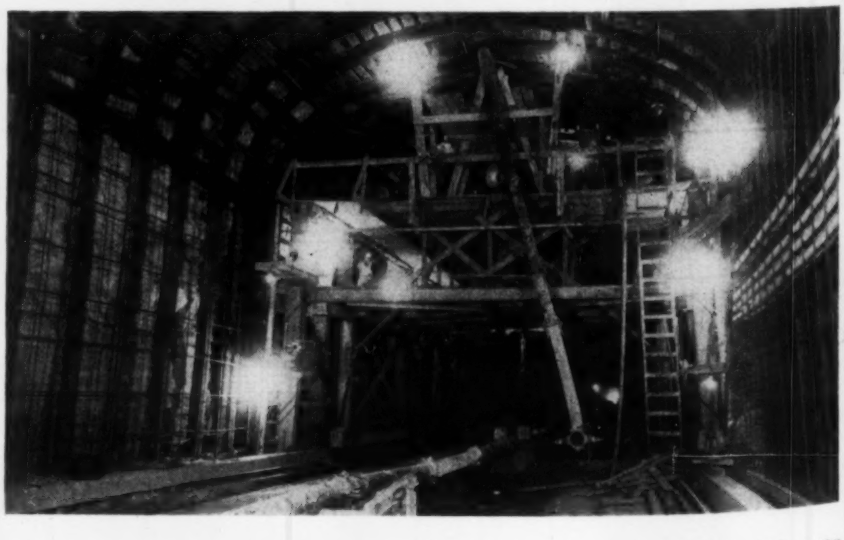
Two full-sized girders will be tested to failure—one 160 ft long and one 74 ft long. The girders are being cast and will be tested at a site near the bridge, at Wissahickon Avenue and Walnut Lane, to determine the accuracy and reliability of the design computations and to give the engineering profession an opportunity to observe the action of these girders under load. The contractor began work on the test girders in May and expects to make the tests late in the summer.

The Preload Corporation of New York, of which Curzon Dobell, Assoc. M. ASCE, is vice-president, and C. C. Zollman, Jun. ASCE, is staff engineer, assisted in the design and preparation of plans, and is constructing the prestressed concrete portions of the structure.

The Walnut Lane Bridge is being built under the supervision of Samuel S. Baxter, M. ASCE, Assistant Chief Engineer of Philadelphia's Bureau of Engineering, Surveys and Zoning. Thomas Buckley, M. ASCE, is the city's Director of Public Works, and Roy Larson is architect for the Art Jury. Without the cooperation of these three, the first prestressed bridge in the United States would have been started elsewhere than in Philadelphia.

Traveler Places Steel Forms to Facilitate Lining of Saltsburg Tunnel

CONCRETING OF SALTSBURG TUNNEL makes rapid progress, using two travelers, one for sidewalls followed by one for arch. Travelers run on tracks with wide clearance to facilitate passage of equipment. View from in front of Blaw-Knox sidewall traveler shows steel liners and slats used to support rock formation and reinforcing bars in place. Traveler is placing steel sidewall forms. Contractor poured 180 ft of sidewall and 180 ft of arch per week. Each 60-ft setup of forms was stripped, moved, cleaned and reset in about $1^1/_2$ hours. Tunnel, now completed, is 2,660 ft long, 30 ft wide and 28 ft high and provides double track for Pennsylvania Railroad relocation required by Conemaugh Dam flood control project of U.S. Corps of Engineers on Conemaugh River near Pittsburgh, Pa.



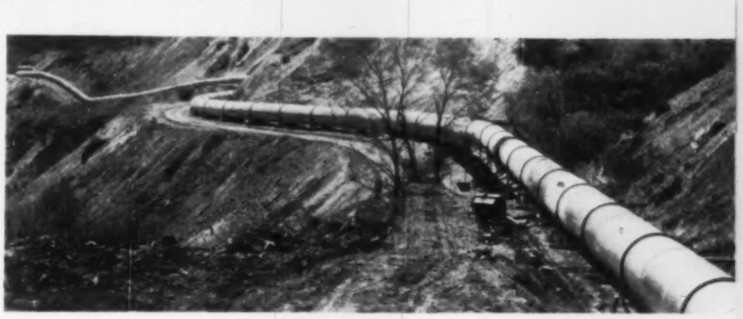
Large-Diameter Steel Pipe Replaces Power Flume

Olmsted Hydroelectric Plant in Provo Canyon, Utah, Returned to Operation 91 Days After Shutdown for Removal of Flume

T. A. PURTON

Chief Engineer, Utah Power & Light Co., Salt Lake City, Utah

UNPRECEDENTED POWER DEMANDS during the Spring of 1948 limited the construction period for 2¾ miles of thin-shell ($^{3}/_{16}$-in.) steel pipeline to 91 days. The 8-ft 6-in.-dia. pipeline was built to replace a 10×7-ft wooden power flume which carried water along the rugged walls of Provo Canyon, Utah, to the Olmsted Hydroelectric Plant. ▸ Design features include steel pedestal supports, flexible joints over a stretch of poor soil, and a double siphoning spillway at the lower end of the pipeline. The project is an example of coordinated construction to save time and money.



SHEET STEEL PIPELINE, which replaces timber flume, carries water to Utah Power & Light Company's Olmsted Power Plant. Pipeline, winding along 2¾ miles of Provo Canyon's steeply sloping walls, was completed 91 days after power plant was switched off.

SEVERAL FEATURES of design and construction gave engineering interest to the thin-shell, large-diameter pipeline completed last spring at the Olmsted Hydroelectric Plant of the Utah Power & Light Co. in Provo Canyon, about 40 miles south of Salt Lake City. The contract included the demolition of 2¾ miles of timber flume 10 ft wide by 7 ft high and its replacement with an 8-ft 6-in.-dia steel-pipe flow line along a winding and precipitous canyon wall.

Design of the pipe was based on detailed investigations conducted some years ago by William Jennings, Chief Design Engineer, and Harold Boehmer, Assistant Chief Design Engineer, of the Utah Power & Light Co., to find a better and more economical design for the support of large-diameter wood-stave pipelines. As a result of this investigation a ring-girder type of support was developed. In this type of design the moments and stresses in the ring girders are calculated from formulas developed from the theorem of least work.

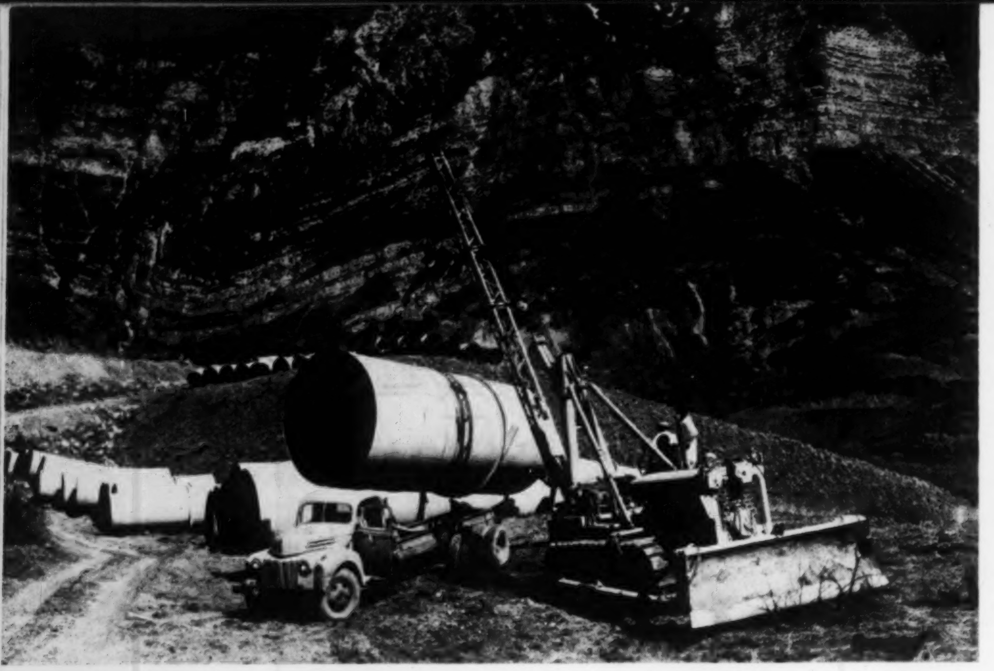
The investigation involved the calculation of deflection around the ring girder at all points, employing the unity load method. Since there was no bond between the outer surface of the wood staves and the supporting steel ring girder, it was assumed that no moment would be transmitted to the girder and that all forces due to the water load were transmitted through the pipe staves radially.

Although there is some inherent rigidity in a wood-stave shell when the pipe is new, there is very little after it has been watersoaked and in service for a short period. To test the correctness of the findings of the investigation, a model pipe was constructed in such a way that it would have no circumferential rigidity. This result was accomplished by fastening or stapling the staves to the cinch bands, maintaining a small space between staves, and then lining the pipe with a thin rubber sheet. The ends of this experimental section were bulkheaded in such a way as to offer no end restrictions. Thus all loading on the pipe was resisted solely by the ring girders and their supports.

The results of this test, in which the deflections at various points around the ring girders were measured with micrometer dial gages, proved the calculations to be 97 percent accurate, based on the calculated deflections.

With the increase in the cost of lumber, the cost of a wood-stave pipeline or of a wood-stave semicircular conduit was prohibitive for the project. However it was felt that the same theory would apply

CRANE AIDS in demolition of wooden power flume, 10 ft wide by 7 ft high, to make way for new steel pipe of 8-ft 6-in. diameter. Demolition of old flume and construction of new pipeline were carefully coordinated to secure an early completion date.



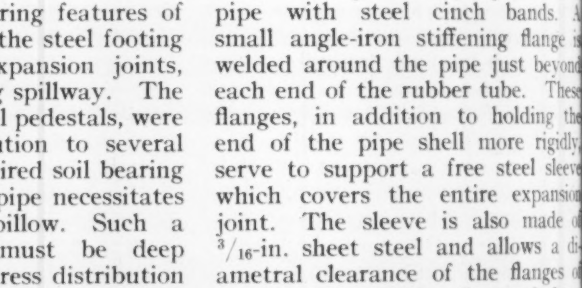
SECTIONS OF PIPE 8 ft 6 in. in diameter are placed along right-of-way prior to switching off powerhouse to permit start of replacement work. Photo shows 24-ft section being removed from truck by Caterpillar D8 tractor with Hyster Hystaway.

very closely to a thin-shelled metal pipe supported in the same manner except for the one condition that the shell would be welded to the ring supports, effecting a bond which would not exist in the case of the wood-stave pipe. The inherent stiffness of a section of thin metal shell without supporting rings is so small as to be considered negligible for practical purposes. However, there is a distance of influence each side of the ring girder where the metal shell acts as an integral part or flange of the girder, thus increasing the section modulus of the girder. This distance of influence is not believed to be very great and probably is a matter of inches, since the greater the length of influence assumed, the closer the centroid of the composite section moves to the shell itself, thus neutralizing the effect of the difference between the inside shell radius (the loading radius) and the centroid radius (reaction circle).

The steel-pipe design adopted for the project is composed of $^3/_{16}$-in. plate throughout with ring girders of 4-in. structural T's welded to the shell at intervals ranging from 24 to 48 ft, depending on the terrain. The ring girders are in turn supported by short legs made of I-beam sections welded to the ring girder and provided with a base plate approximately 6×6 in. The flow line is not a pressure line except for two siphons along its course. It is provided with air-vent pipes of 24-in. diameter at intervals of 500 ft over its entire length and is to operate at various capacities from half full to completely full. At maximum capacity there will be a nominal head in the vent pipes in the upper part of the line. Except for specifically located anchored supports, the pipeline is free to move on its footings to accommodate expansion and contraction due to temperature changes.

Steel Footing Pedestals

The three engineering features of unusual interest are the steel footing pedestals, flexible expansion joints, and double siphoning spillway. The first of these, the steel pedestals, were developed as a solution to several problems. The required soil bearing area for the loaded pipe necessitates a wide concrete pillow. Such a foundation either must be deep enough for proper stress distribution or must be structurally reinforced. The former type is cumbersome, the latter complex, and both are costly. By using a pyramidal four-legged flat-top pedestal, a quick and adequate support for the empty pipe in the construction stages was provided. The pedestal distributes the load to the concrete pillow, minimizing the reinforcement required. It also permitted the concrete work to be carried on independently of the pipe erection, and it provided an excellent table or surface on which the supports could move, thus allowing for expansion and contraction of the pipe.



PORTION OF OLD TIMBER FLUME serves as bridge over which materials for enlarging tunnel (center background) are moved. Double siphon will be placed at entrance to tunnel to provide for overflow when generating load at powerhouse drops off.

Flexible Expansion Joints

The pipeline crosses a mud-slide area where the ground is unstable and frequently has moved or slid distances ranging from inches to feet. Since there was no practical method of avoiding this area, flexible joints were developed to permit the sections of pipe to move with the ground.

Across this area the joints are spaced every 48 ft with a ring-girder supporting structure 4 ft each side of each joint. The joint itself consists of a 6-in. gap in the steel pipe, bridged by a rubber tube of the same diameter as the pipe. The tube is $^3/_8$ in. thick and 18 in. long, providing a 6-in. lap over the steel pipe on each side of the gap. The 6-in. overlaps are clamped to the pipe with steel cinch bands. A small angle-iron stiffening flange is welded around the pipe just beyond each end of the rubber tube. These flanges, in addition to holding the end of the pipe shell more rigidly, serve to support a free steel sleeve which covers the entire expansion joint. The sleeve is also made of $^3/_{16}$-in. sheet steel and allows a diametral clearance of the flanges of about $^1/_2$ in. Thus the steel sleeve supports the rubber tube in much the same manner as an automobile tire casing supports the inner tube. The free sleeve with the large diametral clearance permits a wide range of movement between the pipe sections in any direction.

A spillway is required at the lower end of the pipeline where the flow emergees from the tunnel and before it enters the open pressure box at the head of the penstocks. When the generating load suddenly drops off, the flow must be diverted to prevent the pressure box from overflowing. To accomplish this diversion, a spillway is provided just ahead of the tunnel entrance portal. The spillway consists chiefly of two transition sections which bring the flow from the round pipe to the open U-shaped spillway structure and back again to the round pipe.

If the water were permitted to spill directly over the side of the open U-section with a weir crest of allowable height, a long crest, an expensive structure and a wide spill race would be required. Therefore two siphon hoods were placed over the top of the open U-section. These siphons connect with conduits on opposite sides of the U-section. The conduits join underneath the center of the section and the water then flows horizontally for a distance of about 4 ft. The mouths or entrances to the siphon hoods are horizontal and are placed approximately 6 in. below the maximum allowable water surface. A vertical weir with its crest at the maximum flow rate water surface, extends horizontally across each siphon throat and overflows when the water rises beyond this level.

SPILLWAY DISCHARGES excess flow in pipeline when generating load suddenly drops off. Spillway is located at lower end of line where flow emerges from tunnel through rock cliffs and ahead of entrance to open pressure box at head of penstocks. Discharge from spillway prevents pressure box from overflowing.

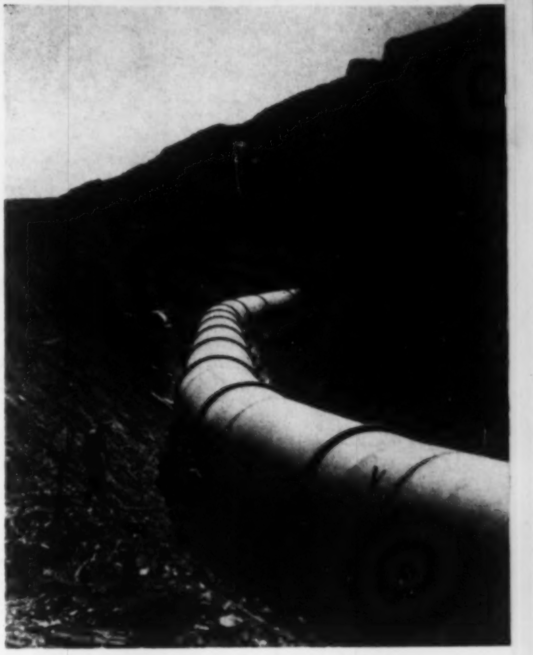
This overflow starts the siphoning action, which draws the water out of the pipe at a rate slightly greater than the full capacity rate of the pipeline. The water surface in the open U-section will continue to drop until the mouth of the siphon is exposed, at which time the siphoning action is broken. This action continues until the generating load has been resumed or until flow in the line has been cut off at the headgates.

Fast Construction Schedule

Another interesting feature of the project was the blitz construction schedule. Because of the unprecedented demand for electric energy, this plant could only be spared from the generating system for 91 days during the spring runoff season, when reservoirs at other stations could be maintained at relatively high levels. Before the plant was shut down, all possible preparations were made to facilitate operations and make certain of completion on schedule.

For weeks before the scheduled switch-off as many of the field sections of the pipe as possible were hauled to or near their grade positions on specially constructed trucks and trailers over access roads built for the project. The field sections were, for the most part, 24 ft long, made of three 8-ft sections butt-welded together in the shop with one ring girder in place. The pipe was shop treated on the inside with bitulithic enamel to a thickness of approximately $^3/_{32}$ in., and with zinc chromate primer on the outside. After erection the outside was finished with aluminum paint.

To eliminate delays caused by concrete work and curing time, the special prefabricated steel pedestals were distributed along the grade. These pedestals had sufficient bearing area to support the empty pipe and could be concreted in with relative ease as pipe laying progressed, without interfering with the assembly crews.



PREFABRICATED STEEL PEDESTALS resting on concrete pillows support pipe every 24 to 48 ft. Pipe is free to move independently of pedestals to allow for expansion and contraction due to temperature changes.

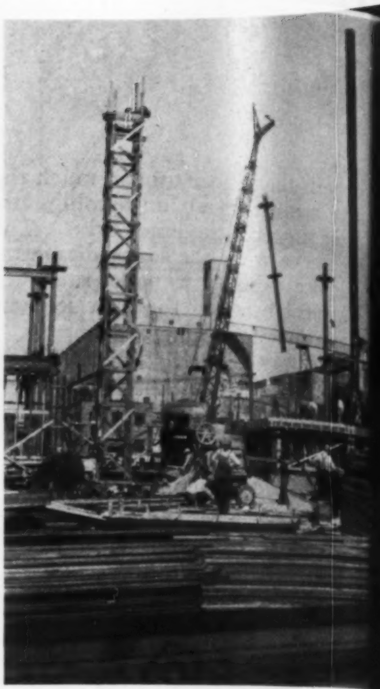
The plant was taken out of service and construction operations began on the $755,000 project March 7, 1948. The first operation was the removal and disposal of the existing timber flume. Next the grade was trimmed and rehabilitated to accommodate the new pipeline. Each and every shop section was stenciled with its own piece-mark number and had a specific position in the line. Laying, fitting and final welding of the line were started simultaneously at several locations along the grade with independent crews and equipment, and the portions were eventually joined to form the completed project.

During the first half of the construction period the work was dogged with frequent snows, winds, rains and mud which made operations with heavy mobile equipment extremely difficult. However, in May the weather became more accommodating, additional shifts were employed and operations were extended around the clock. At 3:00 a.m., June 6, the headgates were opened and water sped through its new course to the generating units—91 days after the artery had been cut.

The steel plate for this project was rolled at the Geneva Steel Company's Plant, which is very close to the Olmsted Plant. The conduit was fabricated at a temporary shop set up for the job in Provo, Utah, by Morrison-Knudsen Co. and Olson Manufacturing Co. of Boise, Idaho, joint contractors for the project.

Many Openings in Factory Floor Lead to Choice of Flat-Slab Construction

WALTER H. WHEELER, M. ASCE
Consulting Engineer, Minneapolis, Minn.



TRACTOR CRANE weighing 25-tons lifts second-tier steel columns into position. Columns support slabs for preparation building, part of Archer-Daniels-Midland Co.'s new solvent extraction plant in Minneapolis.

HIGH LOAD CONCENTRATIONS from heavy machinery and the need for numerous openings through the floor slab pose problems to the builder of an industrial building, who must meet the specific requirements of a manufacturing process. In the case of a linseed and soybean oil preparation building, part of Archer-Daniels-Midland Company's new solvent extraction plant in Minneapolis, Minn., for the manufacture of linseed and soybean oil products, the nature of the plant processes and equipment made it essential to provide a great many openings through the floor slabs. This requirement was met by the development of a flat-slab design with steel grillages built into the slabs in place of the usual flared caps and drop panels.

The wisdom of the design chosen became more and more apparent as the job progressed, as throughout the planning and construction stages numerous changes were made in the arrangement of equipment which usually involved changing the position of both large and small openings through the floor slabs. It was not always easy to accommodate these changes with the flat-slab design but it would have been practically impossible with the beam and girder design originally proposed for the building.

Two Types of Support for Foundation

A considerable part of the plant site is on fill overlying a peat bog, but at the northwest edge of the property there is an island of glacial drift consisting of sand, gravel, clay and boulders suitable for spread footings. Most of the plant buildings are built on creosoted wood pile foundations in which the piles range up to 50 ft in length. The preparation building, described in this article, is next to the grain storage elevator, which is on a mat foundation.

Extensive test borings and test loadings made at the site of the preparation building revealed a sharp line of demarkation running through the site from north to south. West of this line the soil readily supported a load of 6,000 lb per sq ft, but east of the line piling was required. To meet this condition the footings of the building were designed as continuous (Fig. 1) running from west to east across the site, with the easterly part of each footing on piles.

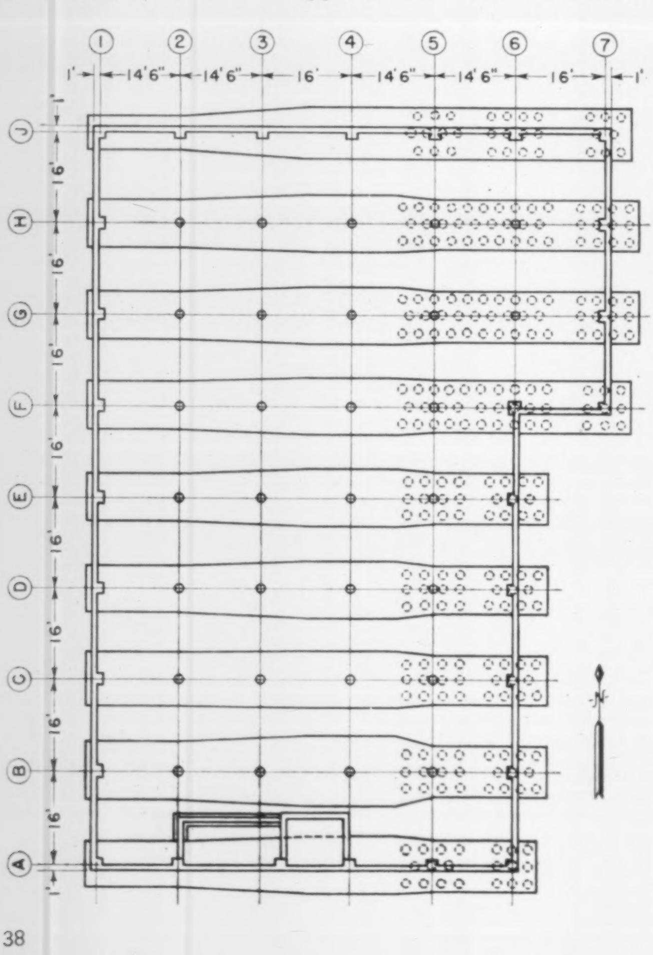
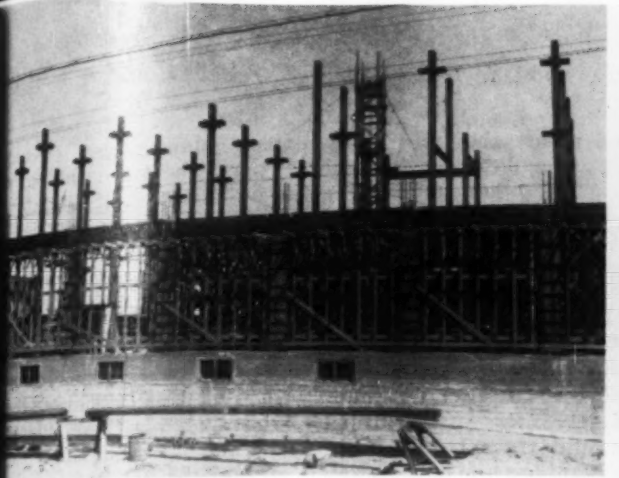


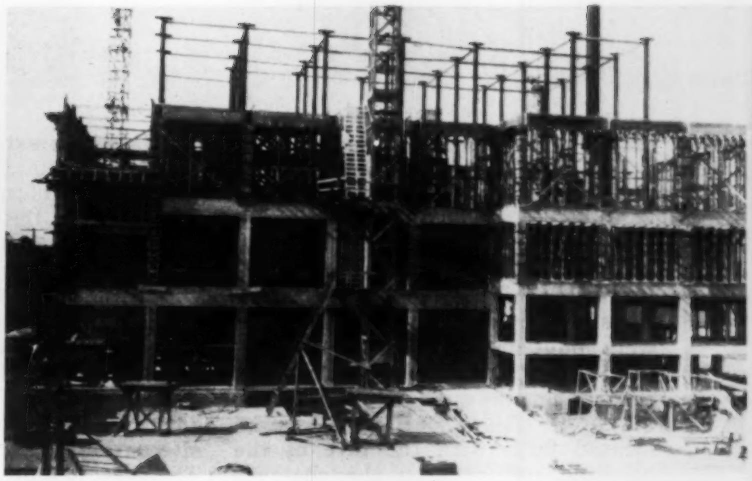
FIG. 1. CONTINUOUS SPREAD FOOTINGS supported partly on soil and partly on creosoted wood piling carry preparation building of Archer-Daniels-Midland Co. in Minneapolis, Minn. Sharp division of soil characteristics through middle of site calls for this type of foundation.

The preparation building is 130 ft long by 92 ft wide, four stories and basement. There are two mezzanine floors and two levels at the third and fourth floors. Total height from basement floor to main roof is 8 ft 6 in. All floors except the lower level of the third are designed for a live load of 200 lb per sq ft. The lower level of the third floor is designed for a uniform live load of 500 lb per sq ft or for the dead weight of equipment plus a uniform live load of 100 lb per sq ft, whichever is greater.

Between column lines 2 and 3 in the center of each of the three adjacent bays D-E, E-F, and F-G (Fig. 2), the slab is pierced by a round hole 10 ft 1 in. in diameter. A steel tank, set in each of the three holes, is supported on the edge of the concrete slab by a steel angle welded to the tank. Each tank is approximately 10 ft in diameter by 30 ft high and weighs about 105,000 lb when filled. Opposite each of these tanks in the same bays between column lines 1 and 2 is a unit of equipment weighing about 95,000 lb which is supported on a base about 5 ft square on the third-floor slab, and which extends through the fourth floor slab



RECTION OF FLOOR-SLAB FORMS follows placing of columns. oor grillages shown at top of columns are shop connected. In at-slab design, steel grillages are built into slabs.



TIMBER BRACING between steel columns at top of structure aligns columns before fourth-floor slab is poured. Exterior columns are of reinforced concrete in contrast to interior columns, which are steel.

oles through the third floor slab e required under each of these units. n the space between column lines and 4 there is a line of machines paced about 12 ft on centers, each eighing about 30,000 lb. Under ach of these machines there is a hole ft square through the third-floor ab.

The 10-ft tanks when empty are omparatively light, but as they are lled and emptied the load on the hird floor slab, where these tanks e supported, constantly fluctuates. n addition the slab is subjected o unbalanced loading caused by the oncentrated weight of the tanks d the other units of equipment.

In order to make the building more flexible and to conserve space, H-section structural steel columns were used on the interior of the building with wall columns and wall beams of reinforced concrete. The steel columns proved of great advantage in the several instances where the design of machinery was changed before installation.

Equipment Change Requires Floor Alteration

At one place a line of five large holes had been provided through the fourth floor slab for the discharge from a large piece of equipment. When the equipment arrived at the job it was found that the manufacturer had radically altered the design and that instead of five holes, four were required. These were so located that they would take out the remaining concrete in the slab, leaving a continuous slot about 25 ft long. The situation was remedied by removing the fireproofing at the top of two of the third-story columns, setting a heavy 14-in-wide flange beam under the slab at the critical point, and welding it to the two steel columns. The new holes were then cut in the slab, the old ones filled, and the equipment set. If the interior columns had been of reinforced concrete instead of structural steel this alteration would have been very

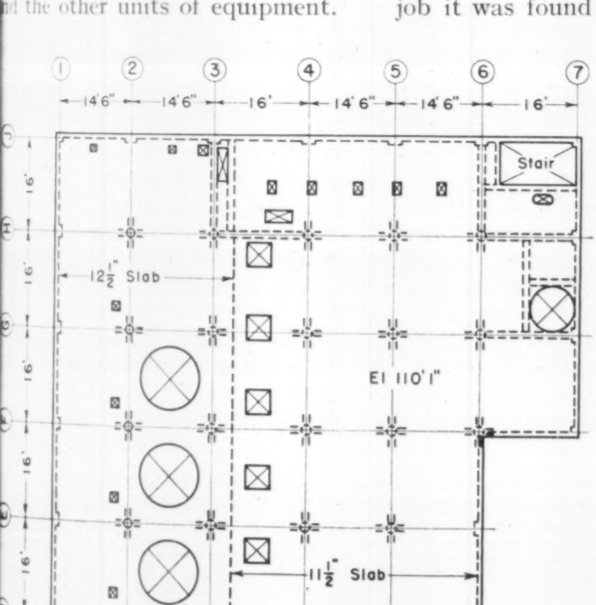
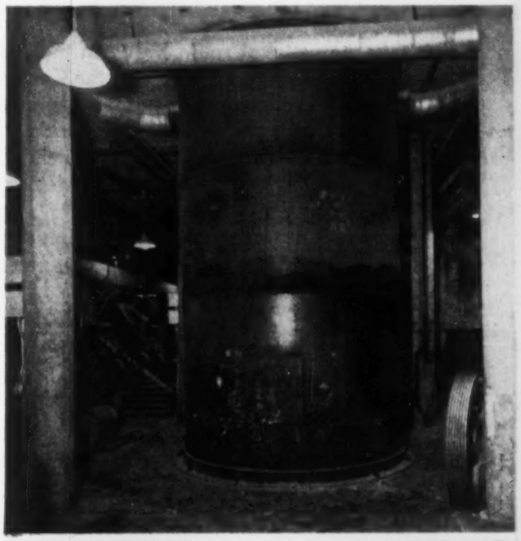
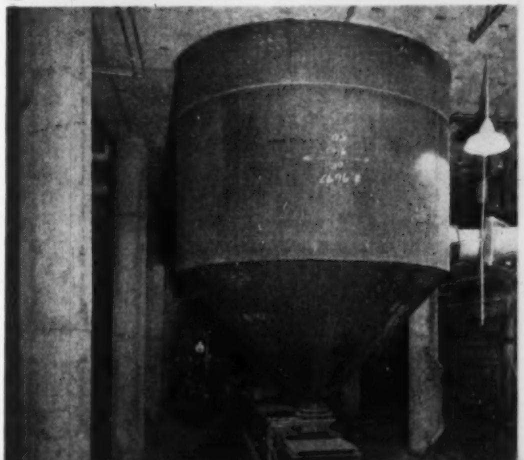


FIG. 2. Third-floor slab (left) is perforated with numerous holes for elevator shafts and multi-story tanks. Loads of 105,000 lb are supported on edge of 10-ft-dia holes in bays D-E, E-F, and F-G between column rows 2 and 3. Changes in arrangement of machinery during construction period frequently made it necessary to alter position of floor openings.



THREE TANKS, 10 × 30 ft, puncture floor slab. Tanks are supported on third-floor slab. See view above, right. Presence of supporting legs on second floor would have been serious impediment to hopper operations. See second-floor view, below, right.



difficult and more expensive, and would have delayed completion of the plant.

Provision for Future Floor Openings

To further improve the adaptability of the building for making alterations in equipment, sheet-metal boxes were built into the concrete slabs near practically all interior columns and along the outside walls of the building. These 8×10-in. boxes are located flush with the face of the columns and between the channels of the floor grillages, with $^1/_4$-in. steel top and bottom cover plates flush with the top and bottom of the slab. When it is desired to run a new conduit or pipe or small duct through a floor, it is only necessary to pick out the best location, burn the necessary hole or holes through the top and bottom plates of the box and run the pipes through.

Inserts for hanging equipment from the ceilings were built into the slabs at regular intervals. Continuous slot inserts which extend across the full width of the building at regular intervals were preferred, but were not obtainable at the time the work was done and the individual inserts were used as a substitute.

The slabs in this building were designed with all straight bars in the column bands, except at the outer ends of the wall bays where the top bars are hooked at the outer end. The middle bands have the usual alternating straight and truss bars. There is a definite advantage in using straight bars in a slab that has as many openings through it as the slabs in this building, since a much better distribution of the bars is possible where openings occur.

Most of Steel Erected by Crane

The basement floor is a reinforced concrete slab supported on the footings. Pockets were left in the slab for setting the bases of the steel columns, thus providing an excellent working base for the first-floor forms.

The steel columns were erected in three tiers, the basement story being the first tier. A 25-ton caterpillar crane was used to set the basement columns and the second-tier columns. For setting the second tier of columns, the crane was moved up onto the first floor slab. The grillages were attached to the columns in the shop. Field connections were made with rivet bolts. Some of the third tier of columns were erected with the crane operating from the ground around the building and the rest with a stiff-leg derrick set up on the third-floor slab.

Fegles Construction Co., Ltd., of Minneapolis, Minn., were the builders of the plant. Kenneth W. Robertson, Assistant General Superintendent of Archer-Daniels-Midland Co., was in charge of engineering for the company, and he and his staff made all the plant layouts. The writer as structural engineer designed seven of the buildings in the plant, including the preparation building

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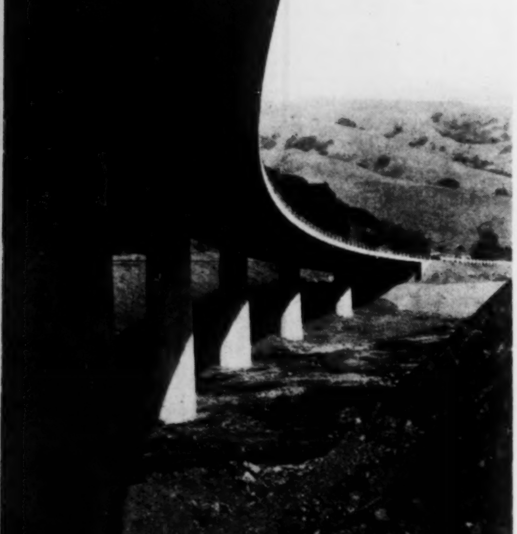
Single-Column Bridge Bents Offer Minimum Hindrance to Alameda Creek Flow

ELIMINATION OF FIVE sharp highway curves and a narrow wooden bridge has been effected by completion of the $450,000 Alameda Creek Bridge in Niles Canyon, California. Affording the only water-level route between the San Francisco–Oakland area and the Central Valley, this picturesque but narrow canyon must accommodate two railroads, an aqueduct and State Highway Route 107, new alignment for which is provided by the new bridge.

Since Alameda Creek has a high runoff and carries large amounts of debris, it was necessary to provide piers which would obstruct the channel as little as possible, especially since the high skew angle of the crossing caused a large number of columns to fall in the creek bed. Therefore a continuous type of structure was chosen, with single-cell box girder and cantilever arms to support the 25-ft-wide roadway. For more than half of its total length of nearly 1,000 ft, the bridge is on a 750-ft-radius curve, with an 11-percent superelevation of the deck.

Piers are founded on rock a few feet below the stream bed. Formwork was complex since the cylindrical pier shafts vary in height from 35 to 55 ft and are battered 1:48. The forms were made of individually tapered sections with a hollow section 4 ft in diameter in the center of each column. In the widest part, the box girder is composed of three cells, dropping to two over the railroad crossing, and finally to one for the last six spans.

Design and construction of the Alameda Creek Bridge, more fully described in *California Highways and Public Works,* was under the supervision of F. W. Panhorst, M. ASCE, Assistant State Highway Engineer—Bridges. The job was done as a joint venture by R. G. Clifford and Louis Biasotti & Son, the former firm constructing the bridge and the latter doing the grading and paving. E. R. Foley was Resident Engineer for the California Bridge Department.



Engineers' Notebook

Tungsten Carbide Core Bits Expedite Subsurface Explorations in Canal Zone

THOMAS F. THOMPSON, Affiliate ASCE

Chief, Geology and Explorations Section, Walla Walla District, Corps of Engineers;
formerly Chief, Geology Section, The Panama Canal

CORE DRILLING has been used extensively in the region traversed by the Panama Canal to secure subsurface geological data needed for the design and construction of the Canal and appurtenant structures. Between the time of the old French company, which commenced operations in 1881, and the present, more than 8,000 core holes have been completed, with an aggregate footage of over 1¼ million lin ft.

Most of the formations explored by drilling are relatively soft, consisting of shales, argillaceous sandstones, and partially altered pyroclastic rocks of low silica content in which the feldspars exhibit incipient to complete decomposition into clay minerals. Irregularly shaped masses of very hard igneous rock are interspersed with the soft types and originated as flows, dikes, sills, and laccoliths.

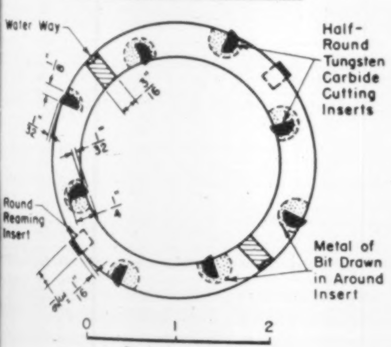

20° Rake From Cutting Edge
3"/16
Reaming Insert
Water Way
Water Way
5"/16
1"/32
1"/4
1"/16
Half-Round Tungsten Carbide Cutting Inserts
Round Reaming Insert
Metal of Bit Drawn in Around Insert
0
1
2
Scale in Inches

FIG. 1. BIT USED successfully at Panama Canal for coring hard rock consists of eight tungsten carbide half-round inserts placed in NX (2⅛-in.) core bit of low carbon steel. Number of inserts is sometimes increased to 12 for coring exceptionally hard formations, as additional inserts increase cutting capacity and provide added strength under greater pressures required for hardrock drilling. For smaller bits (BX and AX sizes), only six cutting inserts are employed.

Early Use of Steel, Diamond and Borts Bits

In the early days of Canal investigations, when equipment and coring techniques were relatively crude, most of the softer strata were cored by means of hand or horse-powered drill machines, using saw-toothed, tempered steel bits. The harder, igneous rocks required hand-set carbon (black diamond) or borts bits. Saw-toothed bits, because of the abrasive nature of much of the materials drilled, required frequent sharpening and reshaping to maintain gage. The carbon bits were satisfactory for coring both hard and soft materials, but because of the increasing cost of the large stones needed and the ever present danger of losing some of the stones or even the entire bit in penetrating broken, caving, or heaving formations, they were restricted to use by only the most proficient drillers. Borts bits performed well in the hard rock types where the small amount of clearance that could be obtained with their setting was adequate, but in softer, clayey formations they tended to "mud up" and were unsatisfactory.

Several types of hard metal were experimented with in the late 1920's and thereafter, using welding techniques to build up cutting teeth and provide a hard facing for the core bits. Round "haystellite" nibs, ⅜ in. in diameter and of variable lengths, hand set in blank bits, were used as cutting inserts. These gave fair results in some of the soft formations but their performance was consistently poor in hard rocks because of excessive wear at the cutting edges of the bit, chipping or breaking of the teeth when heavy drilling pressures were necessary, and rapid loss of gage.

Research Program Initiated

At the start of extensive drilling for the Third Locks Project in 1939, A. V. Mitchell, who then was general foreman of the Panama Canal Core Drill Unit, initiated a program of research to determine if a better cutting medium could be found for the "NX," "BX," "AX," and "EX" core bits to be employed. Through the cooperation of Dr. George F. Taylor, Research Physicist (later with General Electric Co. and the Carboloy Corp.), tungsten carbide alloy "nibs" of a size and shape adaptable to setting in blank bits in essentially the same manner as carbons are set for diamond bits were secured for experimental use. This material proved superior in strength and abrasive resistance to all other hard metals previously

RESEARCH PROGRAM instituted in 1939 at Panama Canal showed value of tungsten carbide alloy "nibs" hand set in blank bit of low carbon steel. Such bits have been found to average slightly under 100 ft of drilling per bit in rock formations at Canal. Cost is about $16 per bit, including labor for setting nibs.

tried, and thereafter tungsten carbide inserts were adopted for general core-drilling use.

Preparation of Bits

Since 1940, over 95 percent of all local drilling has been performed using tungsten carbide insert core bits. The only materials in which tungsten carbide has been found ineffective are the hardest rocks locally encountered (dense basalts, andesites, and rhyolites). Where these rocks are present in appreciable thicknesses, mechanically set borts bits, purchased from commercial sources in the United States, are used.

In preparing the "NX" ($2^1/_8$-in. core) bits, the blank bits and the tungsten carbide inserts are purchased separately. The blank bits, of low carbon steel, are of the bevel-wall type for use with a split-ring core lifter. They are purchased in lots of 200 or more from core-drill supply companies in the United States at an average cost of $1.50 per bit. The tungsten carbide inserts are purchased from a United States manufacturer in pieces shaped as specified. Cutting inserts are $^1/_4 \times {}^1/_4$-in., half-round pieces with a 20-deg rake from the flat side at one end, and cost 40 cents each. The clearance inserts are short sections of round tungsten carbide rod, $^3/_{16}$ in. in diameter by $^1/_4$ in. in length, and cost 28 cents each.

Normally, eight cutting inserts are employed for a standard NX-size bit, four spaced equidistant around the outer periphery of the face of the bit, and four similarly spaced on the bit's inner periphery (Fig. 1).

Investigations for New Canal

During the period between March 1946 and July 1948, in which investigations were being conducted under Public Law 280, 79th Congress, to determine the location and type of interoceanic canal that will best meet the future needs of the United States, over 63,000 lin ft of core holes were drilled. A careful check was made on performance and costs of tungsten carbide bits used in coring the diverse rock types encountered in this investigation. It was found that the average footage obtained per bit was slightly under 100. Extremes ranged from a maximum of over 700 ft of drilling for a single bit in sampling the softer, sedimentary formations, to as little as 10 ft in hard, igneous materials. The average cost of the bits, including materials and labor required to set them, was $16 each. One man working as a setter proved capable to supplying the bit demands of as many as 12 drill units, and could turn out four bits in an 8-hour day.

This paper was prepared with the permission of the Governor of the Panama Canal. Woodford M. Babbitt and George Phelps of the Panama Canal Core Drill Unit; A. V. Mitchell, formerly general foreman of the Core Drill Unit (now retired); and M. J. Gleason of the E. J. Longyear Co., formerly Chief Inspector of the Geology Section, reviewed the paper and offered constructive suggestions.

Slide Rule Simplifies Open-Channel Computations

CHRISTIAN W. MATTHEWS, Jun. ASCE
Engineering Division, Humphreys Investment Co., Denver, Colo.

CALCULATION of backwater curves and surface profiles, and other problems of open-channel flow, can be considerably reduced by the construction of a special slide rule. This rule, which can be prepared in a few hours, is simply a development of Manning's formula,

$$v = \frac{1.49}{n} R^{2/3} S^{1/2}$$

In preparing the slide rule, the equation is rewritten in terms of logarithms:

$$\log v = \log 1.49 + \frac{2}{3} \log R + \frac{1}{2} \log S - \log n$$

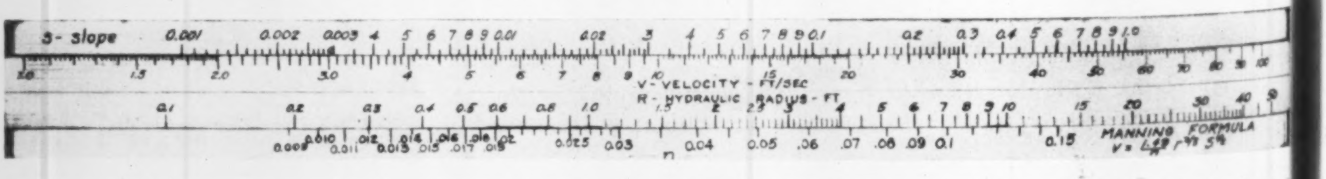
Table I has been calculated for a 10-in. rule, but the values can be reduced or increased for any other size of rule. The scale modulus, *m*, is calculated by dividing the length of the scale by the range of the function. The form of the table is from *Graphical Solutions*, C. O. Mackey (New York, John Wiley & Sons, Inc., second edition, 1947).

In this case, 5 is used as the scale modulus because it keeps the length of the critical v scale within the limits of a 10-in. rule. The equation of the scale is obtained by multiplying the function of the variable by the controlling modulus, that is, 5. The length of the scale is calculated by the direct substitution of the variable limits in the scale equation.

The best results will be obtained if the scales are drafted on a sheet of heavy bond paper and then located in their proper positions on the rule base. A satisfactory base can be prepared by cementing together strips of white cardboard. Poster board, which is available at most stationers, is satisfactory. An inexpensive wood rule may also be used as a base if available.

Drafting of the scales can be simplified by using a sheet of log paper as a base for interpolation. It should be noted that the number preceding each of the logarithmic equations is the scale modulus, or the number of inches required for each cycle of that variable.

For example: $v = 5 \log v$ indicates that the values of v from 1.0 to 10.0 will require 5 in. of scale. This information can be used as a shortcut in the plotting of the scales, for if we locate the lower value on the paper, and scale off the scale modulus, one complete cycle of the variable will



EASILY MADE SLIDE RULE simplifies determination of velocity of flow in open channels or plotting of backwater curves. Few simple calculations involving Manning's formula are necessary to plot *v*, *R*, *S*, and *n* scales, which are then glued to cardboard, or to cheap wooden slide rule used as a base.

TABLE I. CALCULATED VALUES FOR 10-IN. SLIDE RULE

Variable	Limits of Variable	Function of Variable	Range of Function	Scale Modulus	Equation of Scale	Length of Scale, Inches
v	1 to 100	$\log v$	2.00	5	$5 \log v$	10.00
R	0.1 to 50	$^2/_3 \log R$	1.80	5	$^{10}/_3 \log R$	9.00
n	0.009 to 0.150	$\log n$	1.22	5	$5 \log n$	6.12
S	0.001 to 1.000	$^1/_2 \log S$	1.50	5	$^5/_2 \log S$	7.50

have been located. The modulus of the log paper should equal the scale modulus as nearly as possible. Place the index of the log paper on the lower value of the cycle, and divide the scale proportionally.

After the scales have been drafted they should be aligned by the solution of a few sample problems. A check can be made by setting $R = 1.0$ above $n = 0.0149$, after which the answer $v = 10.0$ should be read below the value of $S = 0.01$. The n, R, and S scales should be placed on the rule first, and the v scale then oriented as suggested.

Useful for Obtaining Velocity of Flow

The rule is useful in solving for the velocity of flow in any open channel, but its greatest usefulness is in plotting backwater curves. In most of the standard step methods in common use, the value of the friction slope, S_f, must be calculated. To do this by ordinary means requires the solution of an awkward rewrite of the Manning equation:

$$S_f = \frac{n^2Q^2}{2.21A^2R^{4/3}} \text{ or } S_f = \frac{n^2v^2}{2.21R^{4/3}}$$

The awkwardness of dealing with these various powers and roots is largely responsible for the length of calculations required. This special rule, which is easily constructed in a few hours, will save many hours of later computations.

Solution Presented for Trapezoidal Loading on Beams

ELIHU GEER, M. ASCE

Assistant Professor of Civil Engineering, University of Detroit, Detroit, Mich.

MANY TEXTBOOKS on statically indeterminate structures give formulas for fixed-end moments for a few types of loading which occur frequently. But one of the more frequently occurring types of loading, the trapezoidal loading, seems to have been overlooked; at least I have not found the formula in a book. The trapezoidal loading occurs in the case of beams supporting a two-way rectangular panel. The solution is as shown in Fig. 1.

For the case of uniform loading over the entire span, Fig. 1, $c = 0$, which can be reduced to the well-known formulas,

$$M_{F_{ab}} = -\frac{qL^2}{12}, \text{ and } M_{F_{ba}} = \frac{qL^2}{12} \quad (1)$$

For the case of triangular loading with the apex of q at midspan, $c = L/2$, and the solutions reduce to

$$M_{F_{ab}} = -\frac{5}{96}\,qL^2, \text{ and } M_{F_{ba}} = \frac{5}{96}\,qL^2 \quad . \; . \; . \; . \; . \; . \; . \quad (2)$$

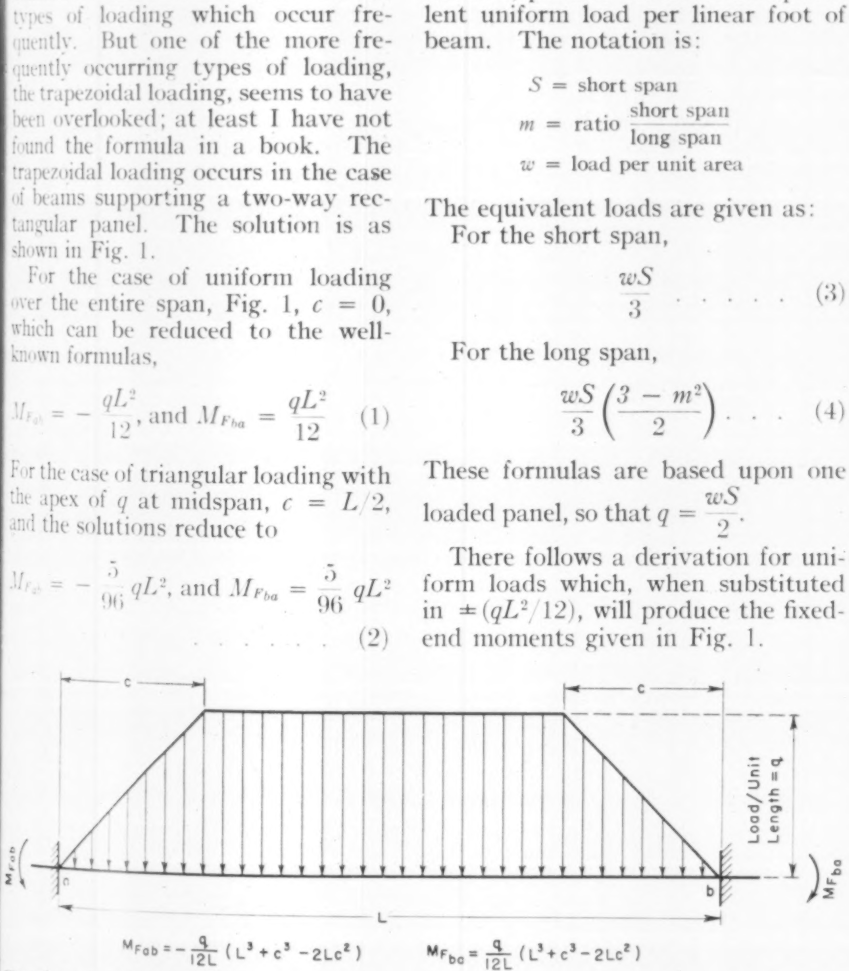

c
c
Load/Unit Length = q
$M_{F_{ab}}$
$M_{F_{ba}}$
a
b
L
$M_{F_{ab}} = -\frac{q}{12L}(L^3 + c^3 - 2Lc^2)$
$M_{F_{ba}} = \frac{q}{12L}(L^3 + c^3 - 2Lc^2)$

FIG. 1. DIAGRAM of trapezoidal loading on beam and solution for fixed-end moments.

The Joint Committee Report (ASCE PROCEEDINGS, Part II, June 1940, Sect. 89) permits the use of an equivalent uniform load per linear foot of beam. The notation is:

S = short span

m = ratio $\dfrac{\text{short span}}{\text{long span}}$

w = load per unit area

The equivalent loads are given as:

For the short span,

$$\frac{wS}{3} \quad . \; . \; . \; . \; . \; . \quad (3)$$

For the long span,

$$\frac{wS}{3}\left(\frac{3 - m^2}{2}\right) \quad . \; . \; . \quad (4)$$

These formulas are based upon one loaded panel, so that $q = \dfrac{wS}{2}$.

There follows a derivation for uniform loads which, when substituted in $\pm(qL^2/12)$, will produce the fixed-end moments given in Fig. 1.

TABLE I. COMPARISON OF COEFFICIENTS OF wS/3

m	$\frac{3 - m^2}{2}$	$\frac{3}{16}(m^3 - 4m^2 + 8)$
1.0	1.0000	0.9375
0.9	1.0950	1.0292
0.8	1.1800	1.1160
0.7	1.2550	1.1968
0.6	1.3200	1.2705
0.5	1.3750	1.3359

For the short span,

$$\frac{q'S^2}{12} = \frac{5}{96}\left(\frac{wS}{2}\right)S^2 \quad . \; . \quad (5)$$

The required equivalent, $q' = {}^5/_{16}wS$. The Joint Committee equivalent is $6^2/_3$ percent on the conservative side.

For the long span,

$$\frac{q''(S/m)^2}{12} = \frac{wS/2}{12S/m}\left[\left(\frac{S}{m}\right)^3 + \left(\frac{S}{2}\right)^3 - 2\left(\frac{S}{m}\right)\left(\frac{S}{2}\right)^2\right]. \quad (6)$$

The required equivalent is

$$q'' = \frac{wS}{16}(m^3 - 4m^2 + 8) \quad . \quad (7)$$

For the purpose of comparison with the Joint Committee equivalent, this is put into the form

$$q'' = \frac{wS}{3}\left[\frac{3(m^3 - 4m^2 + 8)}{16}\right] \quad . \quad (8)$$

and the coefficients of $wS/3$ are compared in Table I.

Here the Joint Committee is on the conservative side by $6^2/_3$ percent or less.

... THE READERS *Write*

Recommends Supersonic Methods for Silt Measurement

TO THE EDITOR: The article by Charles W. Thomas, "Supersonic Methods Short Cut Reservoir Silt Measurements," in the May issue, was read with great interest. About two years ago when the question of the silt deposits in Lake Mead and other reservoirs was under discussion, I suggested to Prof. E. W. Lane that it was quite possible supersonic methods of measurement could be utilized, and that either the Coast and Geodetic Survey or the Navy could furnish valuable information.

In his introduction Mr. Thomas mentions methods used by the Coast and Geodetic Survey and the Army Engineers. The development of sonic and radio methods and, also, of radar has been mainly due to lack of visibility. My experience in hydrographic work with both the C. & G. S. and the Army Engineers leads me to believe that, when objects on shore can be seen and readily identified, there is no better method of location than two sextant angles read aboard the survey boat. An exact position can be computed, if necessary, but usually the fix can be plotted with a three-arm protractor.

In all hydrographic work and also in navigation, ranges are a valuable aid in keeping a ship or boat on a straight course. With a sonic sounder, it is possible to keep a boat exactly on range and at a constant speed, if the helmsman has an eye for ranges. If the positions are plotted in the boat, it is possible to note when the helmsman is drifting off range. The main advantage of having the sextant angles read in the boat is that at the exact instant when the position is taken, a mark can be noted on the sounding record. When the sounding or silt measurements are later scaled from the graph, there is perfect agreement between positions and the marks noted on the graph.

It was my idea that the echo or sonic soundings would be most valuable in the deeper portions of the reservoirs. However if the surveys are made when the reservoir is full, it may be possible to sound over the shoal areas where the silt has been found to be deposited in large quantities. Another advantage of the sextant location is the feasibility of obtaining the exact point of the shoreline for the level of the reservoir at the time of the survey.

I note in a paper on photogrammetry by Leon T. Eliel, in the May 1949 PROCEEDINGS, that a complete topographic map of the original ground surface of Lake Mead was made. It should be interesting to compare the elevations of the original bottom, as scaled from the echo-sounding graph, with the elevations shown on the topographic map. In this connection, considerable information can often be obtained in shoal areas by using a steel rod as a probe.

That the echo-sounding method is being accepted by dredging contractors is verified by the superintendent of one of the larger dredging corporations. His company had been dredging in rock, and it was suspected that shoal spots were the result of silting after dredging. Echo soundings proved the fact beyond a doubt. Incidentally, the job of cleaning up actual rock shoals can be made much easier when the definite locations are shown by the echo soundings.

R. J. AULD, Assoc. M. ASCE
Civil Engineer

San Juan, Puerto Rico

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Explains 15-Year Clause in N.Y. Registration Law

TO THE EDITOR: Many questions have been asked about the "15-Year Clause," also known as the "Eminence Clause," in the New York State law for the registration of professional engineers.

The New York State Board of Examiners, in considering applications for licensing under this clause, has ruled that a mere showing of 15 or more calendar years of experience is insufficient to qualify a candidate for exemption from the written examinations. The clause contains the wording, "...applicants who are possessed of long-established and recognized standing in the engineering profession, who have practiced lawfully for more than 15 years." The qualification "recognized standing" is something that defies exact definition, but authorship of technical papers, advanced studies and degrees, the respect of one's fellow engineers, technical society activities, important achievements, prior registration in other states and, in general, contributions to the profession are important factors in this connection. Before an applicant can be considered under this category, he must show at least 15 net years of lawful practice after graduation from an accredited school of engineering. Nongraduates may also be considered, but in their case the qualification requirements are even more rigorously applied, and in addition they must submit to an oral interview to determine their engineering knowledge, practice, and achievement.

No applicant should consider that the registration requirements have automatically been met merely because the required number of years have elapsed.

D. B. STEINMAN, M. ASCE
Member, New York State
Board of Examiners

New York, N.Y.

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Advises Broad Training for Young Engineers

TO THE EDITOR: It was with great interest that I read Dean Harold E. Wessman's article, entitled "Pendulum Swings Toward the Broadening of the Curricula in Engineering Education," in the April issue. Dean Wessman urges that the pendulum be made to swing in the direction of improving the engineer's ability to write and speak effectively.

I would like to present my ideas on the subject, clarified by an avocation in effective speaking for the past decade. To improve his ability to write and speak effectively, the young engineer should:

1. Study typing—to record his ideas.
2. Study logic—to organize his ideas.
3. Study psychology—to learn how people react to his ideas.
4. Study rhetoric—to put his ideas in forceful language.
5. Study elocution—to develop a resonant and flexible voice for the expression of ideas.
6. Study debating—to apply his knowledge of typing, logic, psychology, rhetoric, and elocution.

I believe that study of these courses will accelerate the pendulum's swinging in the direction desired by Dean Wessman.

MICHAEL YATSKO, JUN. ASCE

New York, N.Y.

Use of "Shove-Joint" in Brick Laying Is Advocated

To THE EDITOR: The article, "Improved Bricklaying Technique," by John R. Farrell, M. ASCE, in the March 1949 issue is very interesting. In connection with the laying of brick, the following from the Fourth Edition of Byrne's *Inspector's Pocketbook* (1930) is similar and of interest.

"Brick should not be merely laid, but every one should be rubbed and pressed down in such a manner as to force the mortar into the pores of the bricks and produce the maximum adhesion. For the best work it is specified that the brick shall be laid with a "shove-joint," that is, that the brick shall first be laid so as to project over the one below, and be pressed into the mortar, and then be shoved into its final position.

"Bricks should be laid in full beds of mortar, filling ends and side joints in one operation. This operation is simple and easy with skillful masons—if they will do it—but it requires persistence to get it accomplished. Masons have a habit of laying brick in a bed of mortar leaving the vertical joints to take care of themselves, throwing a little mortar over the top of the beds and giving a sweep with the trowel which more or less disguises the open joint below. They also have a way after mortar has been sufficiently applied to the top bed of the brick to draw the point of their trowel through it, making an open channel with only a ridge of mortar on each side (and generally throwing some of it overboard), so that if the succeeding brick is taken up it will show a clear hollow."

The fourth edition of this book, is a revision, by the writer, of the three previous editions, the first was published in 1898, fifty years ago. The technique is not new or improved. The practice of obtaining proper, sustained inspection is one item of doing a good job, and it is heartening to read that it is receiving some attention.

S. T. GOLDSMITH, Assoc. M. ASCE
Newtown, Pa.

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Says Personnel Problems Increase Difficulties of Foreign Construction

TO THE EDITOR: To the problems involved in construction operations in the frozen North—described in articles by Messrs. Spofford, Hyland, and Mellish in the January issue—should be added personnel difficulties. In organizing and maintaining a versatile and well-coordinated field engineering staff for off-continent or remotely located work the employer is confronted with a number of personnel problems not ordinarily encountered, each varying in relative importance with the size, type, location, and duration of a particular project.

It is a rare coincidence, indeed, to have a complete and suitable staff available when required. Consequently, with the possible exception of a few key men, it must be recruited of entirely new personnel, necessitating an advertising campaign and a period devoted to interviewing, classifying, investigating, and screening applicants. Experience indicates that by far the great majority of personnel problems arising in an organization of this sort develop from the vagaries and traits of character of its personnel. Foreign work appears to have a fatal attraction for many undesirables and misfits.

The war is in all probability responsible for this condition in part at least, as the serious civilian man-power shortage during that period necessitated the acceptance of personnel types that could not and would not be tolerated under ordinary circumstances—floaters, fortune hunters, sheriff dodgers, gamblers, malcontents, and alcoholics. This is not by any means an indictment of engineering personnel alone, although experience has shown that some otherwise well-qualified men are unfortunately included in one or another of these classifications. It is of the utmost importance to the successful prosecution of foreign work that the personnel should be experienced in their field as well as physically fit, of good character and personality and stable in temperament. Consequently, all applicants not qualifying in these respects must be eliminated by careful screening and investigation. It is conservatively estimated that only one out of twelve of those interviewed becomes a candidate for final selection. Perhaps the factor mainly responsible for this relatively high ratio is the fact that work of this type does not afford family housing facilities, which means that many of the more desirable applicants, particularly those who are family men, flatly refuse to consider such employment. Failure to qualify physically results in the rejection of approximately 3 percent of those otherwise well qualified.

No particular problems are involved in processing personnel as this is largely a matter of paper work. Final physical examinations must be arranged, employment agreements executed, and transportation arranged. Ordinarily and for economic reasons employment agreements are established for a minimum period of one year. On the execution of the employment agreement, the man becomes an employee and must be gotten to his destination as expeditiously as possible. In general, air transportation is considered the most satisfactory mode of travel.

Providing board and room is a routine procedure in most off-continent or remotely located work, and the methods of handling are dependent on the conditions peculiar to the particular project. For pioneer work in virgin territory, tents and a field kitchen are the order of the day, whereas in fixed locations barracks and a central mess hall are more satisfactory. Custom evolving out of wartime conditions has established a more or less universal charge by the contractors of $1.50 per day for these facilities.

In this connection, it should be borne in mind that providing a plentiful supply of good, wholesome food and clean, comfortable quarters is a vital factor in upholding morale. Conversely, poor and improperly prepared food, a slovenly mess hall or field kitchen, and dirty quarters will reduce morale to the lowest ebb and multiply personnel problems a thousand fold. It should also be remembered that the average American considers it an inalienable right to gripe and complain either with or without provocation. Experienced and competent supervision will recognize this tendency for what it is and take corrective steps if necessary or discount it entirely.

HAROLD H. JONES
Senior Engr., Alaska Project
Fay, Spofford & Thorndike

Boston, Mass.

◆

Suggests Donating ASCE Periodicals to Library

TO THE EDITOR: After finishing my copies of ASCE publications and other technical periodicals, I have for the past ten years been contributing them to my local library. There they are enthusiastically read by engineers and surveyors and students, who have thanked me many times through the librarian and who say that they look forward to seeing my publications each month. Perhaps other engineers will wish to do likewise.

FRED A. CAMP, Assoc. M. ASCE
Los Angeles, Calif.

SOCIETY *NEWS*

ASCE Activities Studied at First Eastern Regional Conference

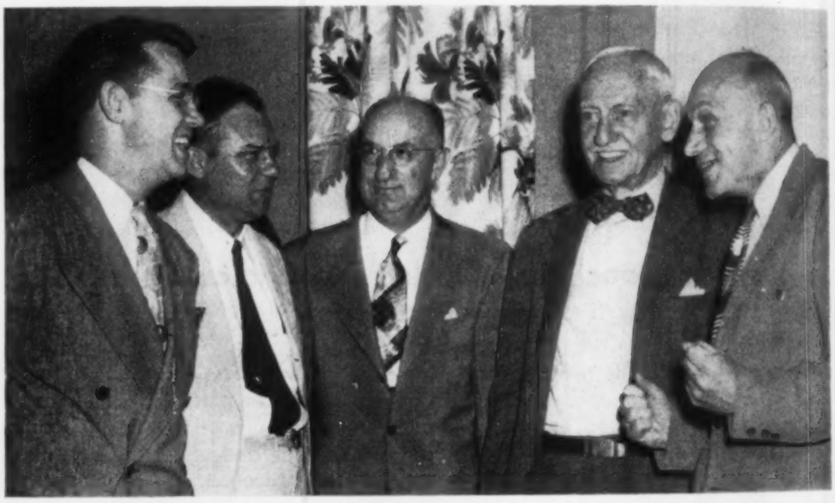
SOCIETY AFFAIRS ON a grass roots level were studied by representatives of six of the eight Sections comprising District 10 in the first regional conference of Local Sections east of the Mississippi. ASCE representatives attending the two-day conference, to which the Tennessee Valley Section was host in Chattanooga on June 10 and 11, were Henry J. Sherman, Vice-President of Zone II, and Edmund Friedman, Director for District 10. In addition to the official Society and Section representation, a number of Tennessee Valley Section members dropped in for informal participation in one or more of the round-table sessions.

Subjects discussed included publications, the proposed plan for Society reorganization, Section and Society finances, membership grades, the relation of the Society to EJC and the National Society of Professional Engineers, and the relationship of Sections within District 10 to each other.

In debating the question, "Why Join ASCE," comments centered about the best means of bridging the transition between the student and Junior engineer, and the way to approach the group of older engineers who were not reached in their student days. It was agreed that the proposed change in Society membership grades to include a student member rank would greatly help the young engineer. The group voted to form a committee to give further study to the subject and formulate a report before the next District 10 conference.

The conference went on record as favoring substitution of "Separates" for PROCEEDINGS on the theory that it would increase the number of papers that could be made available to members. The representatives also expressed themselves as being in favor of the establishment of uniform membership grades and terminology within the Founder Societies, but suggested that the Board of Direction temporarily delay action pending recommendations of ECPD on the subject.

Following discussion of the Harrington plan for ASCE reorganization, the group stated its belief that the objectives of the proposed plan can best be accomplished within the framework of the existing constitution, and recommended holding only two meetings on a national scale annually, substituting for them at least one large-scale District meeting a year. It was the opinion of the delegates that the Society



LOCAL SECTION DELEGATES ATTENDING DISTRICT 10 CONFERENCE are photographed at opening-day luncheon on June 10 (lower group). Starting in left corner and proceeding clockwise around table, view shows W. R. McLean, George H. Maxwell, Paul C. Klyce, Charles Dubois, Thomas Lee, W. R. Eaton, Myron O. Jensen, Ritchey Hume, Frank Thompson, John F. Partridge, Don H. Mattern, Ray L. Forshay, John C. Voorhees, Mrs. Forshay, Mrs. Voorhees, John W. Peerson, Ernest M. Titus, Edmund Friedman, Mr. Clark, Henry J. Sherman, Marion E. Boriss, J. F. Tribble, Lewis Schmidt, Jr., B. T. Sumner, and Wilbur C. Sensing. Representatives from Georgia Section and most of Alabama Section contingent arrived after luncheon and were not included in photograph. In upper photo, Section and Society officers have informal get-together. Pictured left to right are Raymond L. Forshay, vice-president of T. V. Section; Marion Boriss, president of Chattanooga Sub-Section; Edmund Friedman, ASCE Director District 10; ASCE Vice-President Henry J. Sherman; and Ernest M. Titus, president of T. V. Section.

could aid in financing and programming such District meetings since two of its own meetings would be discontinued.

Stating that "The enthusiastic response and the unanimity of thought upon Society affairs were encouraging to those who have felt there is too big a gap between Section and Society activities," the group reports that it will hold District conferences once a year. Present plans call for restricting the 1950 conference to discussion of Society affairs, as did the present conference, and for expanding the 1951 conference into a full-fledged regional meeting of business, professional, technical, and social sessions.

E. M. Titus and J. C. Voorhees, president and secretary of the host Section, acted as chairman and secretary, respectively, for the conference. R. L. Forshay was chairman of the committee in charge of arrangements.

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Washington, D.C., to Be Host to Fall Meeting

THE ROLE OF the civil engineer in local, national, and international affairs will be the general theme of the ASCE Fall Meeting, to be held in Washington, D.C., during the week of October 30 to November 4. The Hotel Statler will be headquarters for the meeting, which will be the first national gathering of the ASCE in Washington since 1928. Under sponsorship of the District of Columbia Section, a full program of technical and social events and of excursions to points of engineering, historical, and scenic interest is being arranged.

Ten Technical Divisions of the Society are planning programs of both current and continuing interest to the profession. They are the City Planning, Highway, Hydraulics, Waterways, Power, Sanitary, Surveying and Mapping, Structural, Construction, and Air Transport Divisions. A full program of subjects and speakers will appear in a later issue of CIVIL ENGINEERING.

The meeting will afford engineers an unusual opportunity to visit a number of research and development laboratories of the federal government that are located in the vicinity of Washington. Inspection trips to some of these installation, including the Naval Ordnance Laboratory at White Oak, Md., and the David Taylor Model Basin at Carderock, Md., are being scheduled for Friday, November 4. Several large construction projects under way in the Washington area will be visited on other inspection tours.

Student Chapter participation in the meeting is being given special consideration. A series of inspection trips to points of particular interest is being arranged for Tuesday, November 1. These will include visits to various construction projects, government research laboratories, and the offices of federal mapping agencies.

The District of Columbia Section extends a cordial invitation to ASCE members to attend the Fall Meeting and to make it the occasion for an extended visit to the nation's capital. Washington, with its monumental buildings, extensive parks, and national shrines, is a beautiful city. Adjacent Maryland and Virginia are especially scenic in the fall of the year, and many interesting drives and excursions to places of historical importance will be available to the Fall Meeting visitors. Tours being arranged include Mount Vernon and a two-day post-convention trip to parts of Virginia, with stops in the Shenandoah National Park and historic Williamsburg.

PRELIMINARY PLANS FOR FALL MEETING ARE BEING MADE BY ASCE GROUP. Reading left to right, photo shows Archie Carter, chairman of committee in charge of arrangements; Daniel D. Walser; Don P. Reynolds, assistant to ASCE Secretary; E. Lawrence Chandler, ASCE Assistant Secretary; Byron Bird, president of District of Columbia Section; and A. G. Fiedler. Photo courtesy of Reni Newsphoto Service.

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EJC Forms Committee on Engineers in Civil Service

ENGINEERS JOINT COUNCIL reports the establishment of a Committee on Engineers in Civil Service, in response to mounting interest in matters pertaining to engineers and engineering in the Federal Civil Service.

The newly established committee, under the chairmanship of Joseph H. Ehlers representing ASCE, has representation of all five EJC constituent societies in its membership. William Huff Wagner, representing AIME, is secretary of the committee. ASCE Past-President Ezra B. Whitman represents ASME; Mark Eldredge, AIEE; and John T. Cox, AIChE.

All members of the committee have had wide experience with Civil Service matters. Mr. Whitman, Past-President of ASCE and current president of the American Institute of Consulting Engineers, resides in Baltimore, the other members in Washington, bringing the committee close to the scene of its operations. According to a preliminary report of the committee to the EJC meeting held in Society Headquarters on June 16, it will maintain close liaison with the U.S. Civil Service Commission and the federal agencies which utilize the services of engineers, thus providing a ready means for exchange of views between the federal government and the engineering profession as represented by the 100,000 members of the five constituent societies. Many technical questions, such as those dealing with job standards and qualifications of engineers, for example, are important in the maintenance of high standards of engineering in the federal government.

The Washington office of ASCE is serving as headquarters for the committee activities.

◆

College Placement Code Is Adopted by ASEE

TO AID IN the placement of engineering graduates in industry, which has become a major operation in engineering schools in the postwar years of shortage of trained technical personnel, the American Society for Engineering Education has adopted a set of "Recommended Procedures in Interviewing and Placement of College Seniors."

Prepared by a special ASEE Committee on Ethics of Interviewing Procedures, in cooperation with representatives of industry and education, the placement code defines the respective responsibilities of industry, of colleges, and of students. Foremost among the responsibilities of industry is listed early notification of the colleges to permit adequate time for scheduling interviews. The responsibility of the college includes informing industries early in the fall of the approximate number of students who will be available for interviews during the school year. Students are urged to thoroughly familiarize themselves with the industry in which they are interested so that they may organize their thoughts and questions, thereby expediting interviews.

The committee, which is headed by M. M. Boring, of the General Electric Co., has also prepared a Standardized Interview Blank. Copies of both the statement of recommended procedures and the standard interview blank may be obtained from Prof. A. B. Bronwell, Secretary of ASEE, Northwestern University, Evanston, Ill.

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Engineers Urged to Cooperate in EJC Survey of Professional Skills

To provide source material for a who's who in engineering research, development, and other scientific operations for use by the National Military Establishment, Engineers Joint Council acting through the ASME has accepted the task of providing the Office of Naval Research with the names, addresses, ages, and professional and scientific qualifications of 100,000 key engineers in all branches of American engineering. To obtain this material, a four-page questionnaire will soon be mailed to 100,000 engineers holding the grade of member or higher in 18 national professional engineering societies. The returns will be collected by the ASME and turned over to the Office of Naval Research for classification.

The source file of key engineering personnel thus obtained will provide a valuable tool for solving a variety of technical personnel problems. Its use will decrease disturbances of the national economy, organization of industry and the personal welfare of engineers, and provide a means by which national resources of technical personnel can be ascertained. The file will also point up weak spots that should be strengthened by education, training, and other means. As a national asset, the body of facts will be available to private industrial, educational, and professional-society planning groups.

The project is the result of a conference of representatives of EJC and many other engineering agencies, held in Washington, D.C., last fall, at which was discussed the need for a list of 25,000 key engineers working in research, development, and other scientific projects who could be called in on a full or part-time basis to work on the broad scientific programs of the National Military Establishment. The task of collecting personal and professional data fell to EJC as the largest joint agency of the engineering profession. The ASME assumed administration of the project as contracting agent of the EJC.

EJC points out that this will not be just another questionnaire, but one sent to engineers selected from the upper echelon of the profession. The data sought are not intended for general government use, but will go directly to the engineering agencies of the National Military Establishment for their use. As the questionnaire will provide the key to opportunity for professional and patriotic service, engineers selected to receive it are urged to give it serious attention and to answer all questions fully.

◆

Student Chapters Receive Board Commendation

In recognition of outstanding achievements during the school year 1948, a number of ASCE Student Chapters were cited for special commendation at the Oklahoma City Meeting of the Board of Direction in April.

The Board's action has been relayed to the 31 Chapters selected, in the form of engrossed Certificates of Commendation and President's Letters of Honorable Mention. The Chapters receiving the Certificates and their geographical distribution are:

Northeastern Region
Cooper Union
New York University
Northeastern University

Middle Atlantic Region
Carnegie Institute of Technology
Case Institute of Technology
Ohio Northern University

Western Region
University of Arizona
California Institute of Technology
Southern Methodist University

Southern Region
Tulane University
Virginia Military Institute
University of Virginia

North Central Region
Purdue University
Rose Polytechnic Institute
Kansas State College

The President's Letters of Honorable Mention go to other Chapters, as follows:

Northeastern Region
Clarkson College of Technology
Connecticut University
City College of New York

Middle Atlantic Region
Lafayette College
West Virginia University

Western Region
University of Colorado
Oregon State Agricultural College
University of Santa Clara
University of Southern California
Stanford University
Texas Technological College

Southern Region
University of Florida
Georgia Institute of Technology

North Central Region
Illinois Institute of Technology
University of Kansas
South Dakota State College

Moisseiff Award Is Activated

MOISSEIFF AWARD
AMERICAN SOCIETY OF CIVIL ENGINEERS

MOISSEIFF AWARD, recently established by Board of Direction and now activated, has dual purpose of honoring the late Leon S. Moisseiff, M. ASCE, and recognizing contributions of other engineers in his field. First award of medal, which is 2½ in. in diameter and made of bronze, went to Prof. George Winter at recent January Annual Meeting for structural engineering paper in "Transactions." Dies were prepared by firm of Dieges & Clust from sculpture of Constanzo G. Luini. Mr. Moisseiff, who died in 1943, was authority in theory and practice of bridge building, and recipient of Society's Norman Medal and James Laurie Prize.

President Thomas Given Honorary Degree at USC

ASCE PRESIDENT FRANKLIN THOMAS, dean of students at California Institute of Technology, was one of five receiving honorary degrees from the University of Southern California during its 66th annual commencement exercises. President Thomas was awarded the engineering doctorate "In acknowledgment of his leadership in the whole field of engineering, academic and applied, and for tireless contributions to the welfare of his community and state."

PRESIDENT FRANKLIN THOMAS (LEFT) IS HOODED by Chancellor Rufus B. von KleinSmid, of University of Southern California, during recent commencement ceremonies in which he was awarded honorary degree of doctor of engineering.

The citation refers also to his presidency of ASCE and to his accomplishments in helping "to make possible the growth and development of Southern California" through his work as originator and long-time vice-chairman of the Metropolitan Water District. After lauding President Thomas' work "as an administrative official at California Institute of Technology for many years," the citation concludes, "A leader in Pasadena city governmental, commercial, charitable, and cultural affairs, he has performed notable service to his fellow citizens."

◆

ASCE Hydrology Manual to Be Issued as Text

THE ASCE *Hydrology Manual*, which has been in preparation since 1940 by the Committee on Hydrology, successively under the chairmanship of Thorndike Saville, W. W. Horner, and Merrill Bernard, will be issued soon as a text and reference volume. For convenience in classroom use, the subject matter has been divided into chapters on precipitation, infiltration, runoff, evaporation and transpiration, and groundwater storage. To make the manual as authoritative as possible, the Committee on Hydrology was subdivided, with a group of authorities in the field working on each chapter.

Details of the publication schedule and methods or ordering will be given in the August issue.

◆

Survey Shows Present Status of Engineers Registration Laws

T. Keith Legaré, M. ASCE
Chairman, Committee on Registration of Engineers, ASCE
Executive Secretary of the National Council of State Boards of Engineering Examiners, Columbia, S.C.

ENGINEERS IN A number of states are trying to improve the laws regulating the practice of engineering, according to the results of a survey completed in April. In all states there is a definite trend toward raising the standards of registration whenever practicable, and toward improving the methods of giving examinations and granting interstate registration. The adoption of amendments providing for the certification of Engineers-in-Training seems to have enthusiastic support in most states, and engineering educators are becoming more interested in this program and are cooperating in putting it into effect.

Thirty of the State Boards report that they do not plan any amendments this year or next. Some Boards believe their present laws are operating very satisfactorily and do not wish to propose minor changes through fear that such legislation may result in undesirable amendments. Many of the Boards still control the funds paid in by registered engineers for administration of the Act, and these hesitate to change their registration laws in other respects as the provision for handling finances may be tampered with. In most states the proposed amendments are sponsored by the state engineering society, with the approval and cooperation of the State Board. However, in a few states the changes are promoted by the State Board, and the members of the profession do not always seem to recognize their opportunity for service and their responsibility to the public.

Eleven states have amended their registration laws during the past two years—some as recently as March 1949. These states are Arizona, California, Indiana, Kansas, Maryland, Minnesota, Nevada, New Jersey, New York, Oregon, and South Carolina. The majority of these amendments are for the purpose of providing for the certification of Engineers-in-Training and the main features are as follows:

Arizona. Provision for membership in NCSBEE and attendance at meetings.

California. To register other classifications besides Civil Engineers and to provide for certification of Engineer-in-Training.

Indiana. To provide for certification of Engineer-in-Training.

Kansas. Repealed optional law and adopted new compulsory law similar to Model Law.

Maryland. To provide for certification of Engineer-in-Training.

Minnesota. Two members added to engineer section of Board and annual renewal fee increased.

Nevada. To provide for certification of Engineer-in-Training, make members of Board not eligible for reappointment except secretary, and exempt mining engineers from provisions of land surveyor act.

New Jersey. To require member of corporation, firm, etc., to be licensed professional engineer if practicing.

New York. To provide for injunctive relief and permit filing of plans by registrants of other states and authorize employment of full-time secretary.

Oregon. Change composition of Board, increase registration and renewal fees.

South Carolina. To provide for certification of Engineer-in-Training, make registration of land surveyors compulsory, provide for written examinations for certain applicants ,reduce renewal fees and include other features of Model Law.

In 20 states various amendments have been proposed, but most of them are pending as this report is written, and it is doubtful if some of them can be passed before adjournment of the state legislatures. The following are some of the features of the proposed amendments:

Alaska. Amendments approved March 25, 1949, include definitions of "Professional Engineer" and of "Practice of Engineering," which are the same as the Model Law. They also provide for examination of candidates who have had at least 8 years of experience or are graduates with at least 4 years experience. Provision is made for certification of Engineers-in-Training and for registration of registrants from other states or countries. The examination and annual license fees are higher than in the states.

California. To provide for appointment of future members of Board from the principal branches of engineering, to include definition of safety engineering and provide for registration as a professional safety engineer. Also, numerous revisions of existing law.

Colorado. To comply with Model Law.

Connecticut. To provide for certification of Engineer-in-Training, examination of all applicants except long-established practice.

Hawaii. To clarify registration requirements in line with Model Law, to increase registration and renewal fees, to simplify handling of funds and authorize employment of secretary not Board member.

Louisiana. New registration act to provide for registration in all principal branches and based largely on Model Law.

Maryland. To provide for land surveyor on Board and amend requirements for surveyors.

Massachusetts. To repeal optional law and make registration law compulsory, based on Model Law.

Michigan. To provide for registration of landscape architects, to revise definition of land surveying, and add other definitions and changes in procedure.

Mississippi. Bill to be presented in January 1950, follows closely the Model Law. However, land surveyors and engineers-in-training are excluded.

Missouri. Separate bills have been introduced which require that persons appointed or elected to engineering positions must be registered engineers; these offices pertain to district engineers, (school, road, drainage or levee, sewer or other municipal corporations); city engineers and county engineers, making it unlawful for any person other than a registered engineer to draw any fee or compensation from public funds for engineering service, except persons now in office. Also a bill requiring the registration of land surveyors and requiring the seal and signature of land surveyors upon maps, plats, etc.

New Jersey. To require written examination of all applicants except those with long practice.

New Mexico. To strengthen law and make in accord with Model Law.

New York. To increase fees.

North Carolina. To adopt requirements of Model Law.

Ohio. To eliminate obsolete sections, clarify terms "professional engineer" and "engineering," outline character of examinations, and define duties and authority of Board.

Oklahoma. To provide for certification of Engineer-in-Training, to repeal exemptions of employees of public service corporations and rural electric cooperatives, to provide for registration of land surveyors.

Puerto Rico. New law following Model Law and authorizing reciprocal registration with other countries in America.

Tennessee. To change years of practice from 4 to 8.

West Virginia. To raise qualifications of non-graduates to 8 years experience and to raise qualifications of Board Members to 15 years experience and 10 years responsible charge.

Wisconsin. To conform to Model Law, including certification of Engineer-in-Training and registration of land surveyors.

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NOTES FROM THE *Capital*

Joseph H. Ehlers, M. ASCE
Field Representative, ASCE

SOME RECENT ACTIVITIES of the Washington office include numerous conferences of national scope and committee meetings of importance to the engineering profession and the construction industry.

The President's Conference on Highway Safety, held in June, was well attended. A report appears on page 58 of this issue.

The annual meeting of the Division of Engineering and Industrial Research of the National Research Council on June 9 brought out an interesting discussion on improving the relationships between the Council and the affiliated technical societies.

The newly created Building Research Advisory Board reported its progress in organization and its possible activities in coordinating research in the field of building materials and methods. Possible activities in connection with a National Water Policy study were discussed. A program for research in highway safety also came in for attention.

Jess Larson, former War Assets Administrator, has assumed command of the Federal Works Agency, following the shifting of General Fleming to the Maritime Commission. Various proposals for changes in the functioning of this Agency are under consideration, including of course both majority and minority recommendations of the Hoover Commission and several bills recently introduced into Congress. One of these proposes a General Service Agency into which the FWA Public Roads Administration and the Public Buildings Administration would be incorporated, along with the Bureau of Community Facilities which is now liquidating an advance planning program and carrying on miscellaneous construction activities under loan and grant programs.

The FWA Construction Advisory Committee, on which the Society is represented together with the architects, general contractors and various planning groups, has studied the place of public works programs in providing some balance to the level of construction activity and the place of advance planning in such programs, and has submitted a statement to the Administrator. This committee advises the FWA Administrator from time to time on policy matters.

Matters affecting engineers in the Federal Civil Service, fees for consulting engineers, and the perennial problem of competitive bidding for engineering services have been discussed with the government agencies concerned and progress has been made in adjusting many of the problems that have arisen.

Representative McConnell's minority report of the House Committee on Education and Labor spoke of "the extremely convincing case" for retaining the provisions of the present law presented by a witness for "a panel of engineering societies representing 165,000 engineers." The report continues, "The stubborn insistence of the majority on going back to Section 9 of the Wagner Act indicates complete indifference to the problems of the professional employee in modern American industry."

Next month legislative matters should be crystallized to the point where a reasonably accurate picture of the situation can be presented with reference to the important matter on which EJC panels have appeared before committees.

A bill authorizing appropriation of $40,000,000 for the advance planning of federal public buildings has been passed by Congress and sent to the White House for the President's signature. It has been estimated that an appropriation of this size would provide sites and plans for $450,000,000 worth of construction when such construction is authorized.

In addition, there are now pending, in both houses of Congress, bills to reinstate the Advance Planning Program, which expired in June 1947. (S.707; H.R.3086) These bills would authorize appropriations of $50,000,000 a year to be loaned by the Federal Works Agency to state and local governments for advance planning purposes.

◆

ASCE Files Worthy Papers in E. S. Library

DURING THE PAST year, a number of papers considered worthy of study and reference by engineers have been filed by the ASCE in the Engineering Societies Library. These manuscripts are available for reference at the Library or, if preferred, photoprint copies may be obtained by arrangement with the Library. Inquiries should be addressed to the Engineering Societies Library, 29 West 39th Street, New York 18, N.Y. Following is a partial list of papers recently filed. Others will be listed in a later issue.

A Linear Approximation Method of Computing Pipeline Network Flow by Prof. Malcolm S. McIlroy. (About 10,000 words of text and tables, plus 12 diagrams.) This paper presents the derivation of a linear-approximation method for finding the values of flows and friction head losses in a network of up to four loops. Included are an illustrative numerical example and a comparison with other methods for the same objective.

Principles of Skeletonizing Pipeline Networks for Analysis by Prof. Malcolm S. McIlroy. (About 8,000 words of text and tables, also 16 diagrams.) Ignoring the branch mains that interconnect trunk mains introduces errors in analysis of a pipeline network. This paper evaluates such error in the indicated friction head loss. The layouts considered include common, ladder networks up to four loops and rectangular grid networks of 16 loops. Results are made applicable to present-day cast-iron water-pipe systems.

Density Currents in Reservoirs—a Review and a Look Ahead by Hugh Stevens Bell, U.S. Soil Conservation Service. (About 7,000 words, well-documented, and 4 photographs.) Calling attention to the many factors involved in considering density currents as related to sedimentation in reservoirs, this paper covers the possibilities of taking advantage of such currents for various purposes by the proper design and operation of the reservoirs through which they may pass.

Analysis of Horizontal Elements of Arch Dams of Variable Thickness by W. A. Perkins, M. ASCE, and J. G. Bastow, Assoc. M. ASCE. (About 7,000 words of text, with 3 diagrams and 9 large design charts.) This paper provides a practical means for designing the type of arch dam that is thickened toward the abutment in order to allow for larger moments. Long and complex formulas have been simplified so as to use values from curves as given in the large charts.

Thermo-Elastic Behavior of Masonry Structures by I. Oesterblom, M. ASCE. (About 11,000 words text and tables, plus 9 figures.) This paper considers the endurance of materials under high temperature and, particularly, the properties that make for thermal stress. Practical equations for the flow and storage of heat in walls and slabs are developed and then applied to more general problems of structural masonry, as seen from the thermal point of view.

Runway Strengths for Air Carrier Operations by Henry Aaron, of the Civil Aeronautics Administration. (About 5,000 words of text and tables, supplemented by 7 graphs.) This paper develops strength requirements for flexible pavements of runways, taxiways, aprons, and runway ends, to accommodate different types of landing gear assembly. In addition to various physical factors, the economic relationships between cost of paving and of modifying aircraft are also considered. It is also shown that pavement requirements can be appreciably reduced when single wheels are replaced by duals and dual-tandem assemblies on very heavy aircraft.

Some Economic Aspects of Columbia River Power by Eugene L. Grant, M. ASCE. (About 5,000 words, text only.) This paper considers the economics of the undeveloped power resources of the Columbia Valley, viewed in the light of the present power shortages. Planning and development of low-cost projects, up to 10,000,000 kw total, is considered under a number of headings.

Irrigation Requirement Data for Central Valley Crops by G. H. Hargreaves, Jun. ASCE. (About 11,000 words of text and tables, plus 3 figures.) Applying data for the Central Valley of California, the paper indicates conditions under which consumptive uses and evaporation approach a straight-line correlation. The author develops an empirical equation, calculating evaporation from climatic data, and gives considerable tabular data in support of it.

Water Power Storage in Maine by Howard M. Turner, M. ASCE. (About 6,000 words of text and tabulations plus 14 illustrations—maps, graphs, and photos.) The author has compiled a wealth of data on water-power storage in the state of Maine, covering a number of watersheds. Drainage areas total 21,000 sq miles, with about 200 billion cu ft of storage, all privately owned.

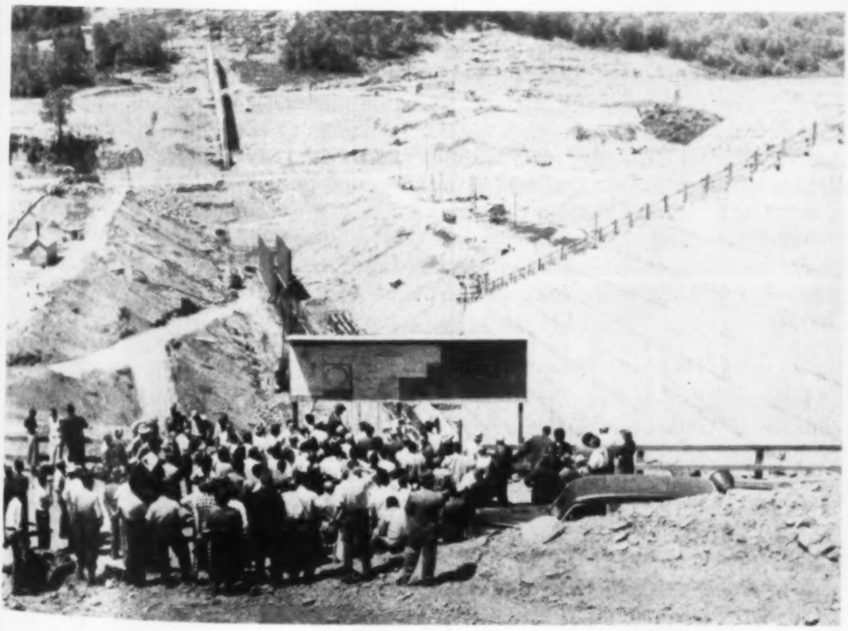
Junior Branch of Metropolitan Section Sponsors Tour of Delaware Project

UNDER SPONSORSHIP OF the Junior Branch of the Metropolitan Section, more than 150 engineers in the metropolitan area enjoyed a recent weekend tour of the New York Board of Water Supply's huge Delaware water supply project being built on the Delaware watershed in upstate New York. The itinerary included inspection of Downsville Dam and the Grahamsville sewage plant on Saturday, and of Neversink, Merriman, and Kensico dams on Sunday. At Kensico, the engineering group had the distinction of being the first visitors to be taken inside the inspection galleries.

Saturday night the Board of Water Supply was host to the engineers at a dinner in Liberty, N.Y. S. Ralph Angell, president of the Junior Branch, spoke in behalf of the Branch, and Thomas K. A. Hendrick, civil engineer for the Board of Water Supply, spoke as representative of that group. The other speakers were representatives of the engineering groups participating in the tour, which included the Society of American Military Engineers, the Municipal Engineers of the City of New York, and the Kings County Chapter of the New York State Society of Professional Engineers.

The excellent arrangements for the trip, made by the Board of Water Supply, included a police convoy for the motor cavalcade, and a sprinkling truck to lay dust at the construction sites.

MORE THAN 150 MEMBERS OF JUNIOR BRANCH OF METROPOLITAN SECTION were guests of New York Board of Water Supply on recent two-day conducted tour of its $375,000,000 Delaware water supply project now under construction in upstate New York. In view at right, Joseph Lewin, M. ASCE, representative of Board of Water Supply (right), chats with Albert Allio, in charge of engineers on Downsville project for Walsh Construction Co. Group inspects corewall of Downsville Dam in lower photo.



TOTAL MEMBERSHIP AS OF JUNE 9, 1949

Members	7,375
Associate Members	9,566
Corporate Members	16,941
Honorary Members	41
Juniors	8,845
Affiliates	72
Fellows	1
Total	25,900
(June 9, 1948	23,571)

NEWS OF LOCAL SECTIONS

Coming Events

Buffalo—Annual inspection trip to observe hopper dredging operations of U.S. Engineer Dredges "Taylor" and "Savannah" in Buffalo Harbor, July 6, at 6 p.m.

Louisiana—Meeting at the St. Charles Hotel, New Orleans, on July 11, at 8 p.m.

Pittsburgh—Inspection tour of the Squirrel Hill Tunnel and Commercial Street Bridge, part of the Penn-Lincoln Parkway System, on Saturday, July 16. Trip will begin at 10 a.m., with briefing concerning construction features. A luncheon at a place convenient to the construction site will follow the trip.

Sacramento—Regular luncheon meetings in the Elks Club, Sacramento, every Tuesday at 12:30 p.m.

San Francisco—Weekly luncheon meetings at the San Francisco Engineers' Club on Wednesdays.

Virginia—Field Day meeting at Buggs Island Dam on July 23, beginning at 10:30 a.m. Luncheon will be served at the cafeteria on the dam site.

Recent Activities

AKRON

Operational features of the proposed Riverlake Belt Conveyor, which would facilitate the transportation of iron ore and coal across Ohio between Lake Erie and the Ohio River were described at a recent dinner meeting by Clifford G. Allen. The plan calls for a series of 172 belts, including branch belts to supply intermediate points, and storage yards at the terminals to permit operation of the belt during the winter when barge operation is suspended. The main belts will be 60 and 72 in. wide, with an approximate speed of 6 mph. Where traveling above ground, they will be supported on structural bents and housed in a light metal tube. Estimated cost of the 103 miles of main conveyor, together with terminal facilities and storage yards, is $210,000,000. Mr. Allen stated that the one major problem still to be solved is obtaining legislative sanction.

ARIZONA

Projected improvements in the Tucson area were outlined in three papers comprising the technical program at the all-day spring meeting of the Arizona Section in Tucson. The proposed truck freeway through the city was discussed by Earle V. Miller, assistant deputy state engineer; the Tucson flood control project by Albert P. Gildea, hydraulic engineer for the U.S. Engineer Office in Los Angeles; and the city sewerage program by William D. Williams, of the Tucson firm of Headman, Ferguson & Carollo. The Section's annual prize of Junior membership in the Society was presented to Robert C. Hall, of the University of Arizona, during the luncheon and Student Chapter program. A resolution endorsing the recommendations of the Hoover Commission and urging Congressional support of the recommendations was passed during the business session. Another resolution praised the work of a recent committee of engineers, architects and contractors that has been working on revision of the Phoenix building code and urged the City Council to take favorable action on it.

CONNECTICUT

The application and interpretation of soil borings was discussed at a recent meeting by Philip Keene, assistant engineer in charge of soils for the Connecticut State Highway Department. ASCE Director Harold Blakeslee summarized the principal events of the Spring Meeting in Oklahoma City and Section Secretary Robert P. Vreeland, Jr., reported on the recent combined conference of New England Local Sections and Student Chapters.

CENTRAL OHIO

Presentation of Section prizes to students at Ohio State University was the principal feature of a recent dinner meeting, at which Section members were guests of the OSU Student Chapter. Charles Newton Brown Civil Engineering Scholarships amounting to $300 each were awarded to Gordon H. Kettering, Arthur A. Miller and Mary H. Kozaki. The Simpson Prize for the best civil engineering thesis in 1949 was presented to W. J. Krueck, Marvin W. Ott, John G. Schenk and Jerome O. Steltenpohl, and the Section prize for the graduating senior with the highest point average in 1948 went to Abba Lichtenstein. Long-range tests on the durability of portland cement concrete were described by Franklin R. McMillan, recently retired director of research for the Portland Cement Association, at a joint meeting with the American Institute of Architects.

COLORADO

Young engineers just entering the profession were advised to take an active part in government affairs at all levels by ASCE Vice-President Robert B. Brooks in the feature talk at a recent dinner meeting. In particular, Mr. Brooks urged his hearers, including over 100 civil engineering students from the University of Colorado, to be alert to any legislation tending to undermine the professional status of engineers. He also spoke on highway and bridge construction in Europe from the vantage point of recent trips abroad. Officers in the newly formed Local Division on Soil Mechanics and Foundation Engineering (May issue, page 63) which will coordinate its activities with the ASCE Soil Mechanics and Foundation Division, are W. G. Holtz, chairman; Jack Hilf, vice-chairman; and Kenneth White, secretary.

IOWA

Various aspects of traffic engineering were presented by Prof. L. H. Csanyi, of Iowa State College, in an illustrated address given at a recent joint meeting of the Section and the Iowa State Student Chapter. Professor Csanyi described his work in expressway planning in the New York metropolitan area.

KENTUCKY

Following a discussion of the control of water pollution, given at the Section's annual joint meeting with Student Chapters at the University of Kentucky and the University of Louisville, the Section passed a motion favoring federal financial assistance to cities of the Ohio River Basin in their efforts to clean up the rivers of the Basin. The motion will be forwarded to Kentucky representatives in Congress. J. J. Wilburn, Jr., of the University of Louisville Chapter, presided in a competitive speaking contest. Winners were W. G. Witt, of the University of Kentucky, who received first price of $15.; H. J. Field Jr., second prize of $10; and J. W. Pochomis, third prize of $5. Mr. Witt also received one of the Section prizes of Junior membership in the Society, and the other went to W. T. Runner of the University of Louisville.

INDIANA SECTION

ASCE Vice-President Robert Brooks was guest speaker at a recent joint meeting with the Student Chapters at Purdue University, Rose Polytechnic Institute, and Notre Dame. Mr. Brooks correlated his general theme, dealing with the duty of the engineer to the government and society, with an account of his travels through Europe as an adviser to the government. The Section presented awards of Junior membership in the Society to the following students: Raul S. Ibanez of Notre Dame, and Robert Lennertz, Galen R. Maus, and Vernon A. Mickleberry of Purdue. RPI is deferring its presentation until its annual joint meeting with the Section in the fall. A special Junior membership award was made by the civil engineering faculty at Purdue to James E. Ballinger.

SPEAKERS' TABLE AT RECENT JOINT MEETING OF INDIANA SECTION with Student Chapters in area includes, left to right, James E. Zervas, treasurer of Purdue Chapter; Robert Jesse, member of Purdue Chapter; Prof. E. A. MacLean, head of Civil Engineering School at Rose; Prof. W. L. Shilts, head of School of Civil Engineering at Notre Dame; Prof. E. C. Thoma (barely shown) editor of "Range Finder," Section newsletter; James E. Ballinger, president of Purdue Chapter; ASCE Vice-President Robert B. Brooks; B. A. Poole, president of Section; Prof. R. B. Wiley head of School of C. E. at Purdue; Robert Grant, vice-president of Rose Chapter; P. D. Miesenhelder, vice-president of Section; and John Pross (not shown), president of Notre Dame Chapter.

KANSAS

Section prizes of Junior membership in the Society were awarded to W. R. Gibbs, of the University of Kansas, and William L. Mertz, of Kansas State College, at a recent dinner meeting. The technical program consisted of a talk on "Termites and Chiggers" by Charles Michener, professor of entomology at the University of Kansas.

LEHIGH VALLEY

About 75 members of the Lehigh Valley Section and their guests made a recent inspection trip to Pottstown, Pa., for the purpose of seeing a model of the Tacoma Narrows suspension bridge in operation at the Pottstown works of the Bethlehem Steel Co. Universal in application, the model is currently being applied to determination of the unstiffened cable and tower deflection for the Tacoma Bridge. A talk on operation of the model was given by its designer, John I. Copp, of Bethlehem Steel. At the dinner meeting in the evening, Raymond Archibald spoke on the design of the Chesapeake Bay Bridge on which he was employed while with the Baltimore firm of J. E. Greiner Co. Mr. Archibald is now with the Public Roads Administration.

LOS ANGELES

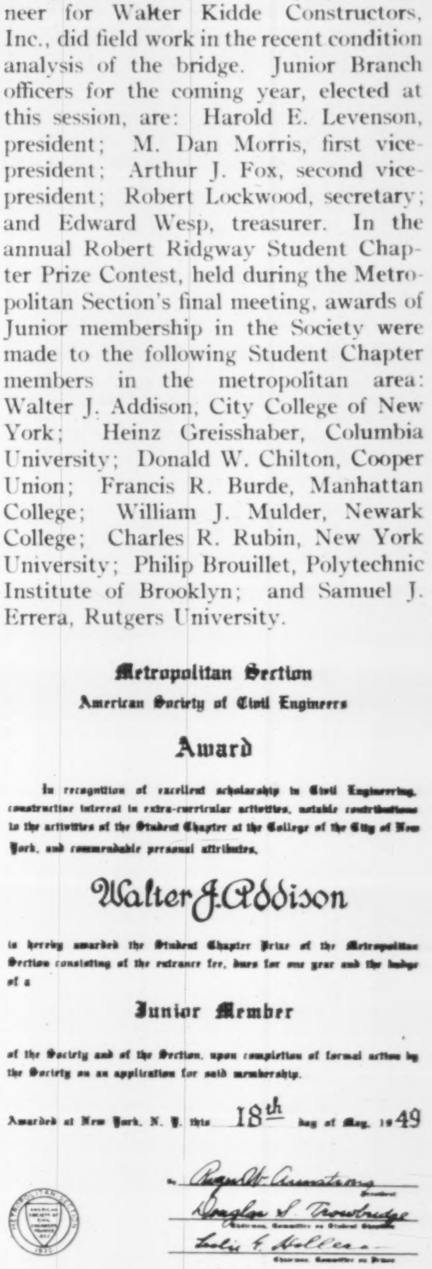
Engineering and science laboratories on the California Institute of Technology campus were visited by members of the Section in the annual open house program and dinner meeting sponsored by the Caltech Student Chapter. The guests were greeted by Franklin Thomas in the dual capacity of President of the Society and dean of students at the Institute. The tour of the campus concluded with inspection of the Astrophysics Laboratory, where all the operating features of the 200-in. Palomar telescope were observed on a one-tenth scale model. Following dinner, John Heath, Jr., and Fred Drury, Student Chapter members, read papers describing the problems involved in transportation and erection of the huge telescope. Charles F. Forrester, Chapter president, was in charge of the program.

MARYLAND

As part of a Section program of interesting students in the Society, Section President Gurney H. Dayett and R. Regnier, chairman of the local Committee on Juniors, spoke at recent Student Chapter meetings at Johns Hopkins University and the University of Maryland. Mr. Dayett, who is assistant bridge engineer of the Baltimore & Ohio Railroad, spoke on bridge design and erection, and Mr. Regnier discussed the advantages of ASCE affiliation and explained the procedure of applying for membership.

METROPOLITAN

Large-scale highway surfacing under way in Guatemala was described at a recent meeting of the Junior Branch of the Metropolitan Section by William Schuelie, sales agent for bituminous-road equipment manufacturers, who recently inspected work in progress on Central American highways. At the wind-up session of the 1948–1949 season, Nomer Gray told of engineering and other problems met by builders of the Brooklyn Bridge. Mr. Gray, who is project engineer for Walter Kidde Constructors, Inc., did field work in the recent condition analysis of the bridge. Junior Branch officers for the coming year, elected at this session, are: Harold E. Levenson, president; M. Dan Morris, first vice-president; Arthur J. Fox, second vice-president; Robert Lockwood, secretary; and Edward Wesp, treasurer. In the annual Robert Ridgway Student Chapter Prize Contest, held during the Metropolitan Section's final meeting, awards of Junior membership in the Society were made to the following Student Chapter members in the metropolitan area: Walter J. Addison, City College of New York; Heinz Greisshaber, Columbia University; Donald W. Chilton, Cooper Union; Francis R. Burde, Manhattan College; William J. Mulder, Newark College; Charles R. Rubin, New York University; Philip Brouillet, Polytechnic Institute of Brooklyn; and Samuel J. Errera, Rutgers University.



Metropolitan Section

American Society of Civil Engineers

Award

In recognition of excellent scholarship in Civil Engineering, constructive interest in extra-curricular activities, notable contributions to the activities of the Student Chapter at the College of the City of New York, and commendable personal attributes,

Walter J. Addison

is hereby awarded the Student Chapter Prize of the Metropolitan Section consisting of the entrance fee, dues for one year and the badge of a

Junior Member

of the Society and of the Section, upon completion of formal action by the Society on an application for said membership.

Awarded at New York, N. Y. this 18th day of May, 1949

by Roger W. Armstrong
President

Douglas S. Trowbridge
Chairman, Committee on Student Chapters

Leslie F. Holler
Chairman, Committee on Prizes

Alfred Hedefine
Secretary

CERTIFICATES OF AWARD presented in Robert Ridgway Competition take this form.

NORTH CAROLINA

Modern weather forecasting as an aid to the construction engineer was discussed by Garrett DeMots, chief of the U.S. Weather Bureau at Raleigh, during the technical program presented at the Section's recent spring meeting at Duke University. The Buggs Island Project, under construction by the Norfolk District, Corps of Engineers, objective of a recent Duke Student Chapter trip, was described by Robert Hazel, Chapter member. In the final paper, J. P. Harland, professor of archaeology at the University of North Carolina, traced engineering designs of ancient Greece from their earliest beginnings in the beehive tombs of the Bronze Age to the remarkable temples of the pre-Christian era. T. P. Noe, Jr., was chairman of the program committee. During the luncheon meeting, Section awards of Junior membership in the Society were presented to Paul C. Stottlemeyer and Leon C. Cheek, both of Duke.

MONTANA SECTION

Beneficial effects of the Pick-Sloan plan for the development of the Missouri River Basin were outlined by W. G. Sloan, co-author of the plan, at the Section's annual dinner meeting. Stating that criticism of the plan has come almost entirely from persons outside the area affected, Mr. Sloan said that irrigation benefits will permit development of hundreds of thousands of acres in Montana and North Dakota and reverse the present trend of migration away from the basin. "The plan will do more for the Indians in the basin than has been accomplished in the past 100 years," he declared. Under a compromise plan, all dams on the Missouri below the mouth of the Yellowstone will be built by the Corps of Engineers, those above it by the Bureau of Reclamation. A capacity audience of more than 225 heard Mr. Sloan.

IN GET-TOGETHER AT RECENT DINNER MEETING OF MONTANA SECTION are, left to right, Henry C. Helland, master of ceremonies; John D. Officer, first vice-president, Montana Section; William G. Sloan, co-author of Pick-Sloan Plan and principal speaker; John H. Morrison, president of Section; Louis Henke, Jr., secretary-treasurer; and Gordon K. Ebersole, who introduced Mr. Sloan.

NORTHWESTERN

Knowledge of the geology of an area is essential to successful construction, Prof. G. M. Schwartz, of the University of Minnesota, told members of the Section at a recent dinner meeting. Speaking on "Geology and Foundation Conditions in the Minneapolis-St. Paul Area," Professor Schwartz emphasized the fact that many construction failures might be avoided by preliminary engineering investigations. Willis A. Jacus, representing the Juniors, called attention to the need for more cooperation between the corporate members and Juniors of the Section, and recommended the appointment of Juniors to all Section committees. Following some discussion of his comments, appointment of a representative number of Juniors to committees was authorized.

Speakers addressing an afternoon meeting of the newly organized South Dakota Branch of the Northwestern Section, held in Brookings recently, were Col. Lewis Prentiss, acting division engineer of the Missouri River Division of the Corps of Engineers, and Talbert Abrams, president of the Abrams Aerial Survey Corp. Colonel Prentiss described the work of the Army Engineers and other government agencies in developing the Missouri River Valley, and Mr. Abrams spoke on aerial photography, commenting particularly on the accuracy of the method. At the evening banquet that concluded the program Dean Eberle, of South Dakota State College, commented on the resources of South Dakota, emphasizing the fact that industry and agriculture must work together for the fullest development of the state.

DEVELOPMENT OF MISSOURI VALLEY is discussed by Col. Lewis Prentiss, acting division engineer of Missouri River Division of Corps of Engineers, at recent meeting of newly organized South Dakota Branch of Northwestern Section.

NORTHEASTERN

Atomic energy was presented as a challenge to the engineer in the principal talk given at the annual spring joint meeting of the Section and the Boston Society of Civil Engineers. The speaker was Arthur D. Weston director of engineering for the Massachusetts Department of Public Health.

PITTSBURGH

The huge road construction program proposed by federal agencies and the states as viewed by the contracting industry was the subject of the feature talk given at a recent meeting by A. N. Carter, manager of the Highway Division of the Associated General Contractors. Mr. Carter showed the gathering—a joint session with the Civil Section of the Engineers Society of Western Pennsylvania and the Constructors Association of Allegheny County—colored slides depicting highway conditions all over the United States. He took the photographs for the slides on a recent extended inspection tour of the country.

The Juniors outlined their experience in their respective fields of engineering since graduation from college at a recent meeting of their group. Structural, railroad, construction, and sales engineering were discussed by Edwin Byrkit, Donald Parsons, Joseph Stein, and R. W. Merchant, respectively. A number of Student Chapter members at the University of Pittsburgh and Carnegie Institute of Technology were guests of the Juniors.

PUERTO RICO

Proceedings of the recent First International Congress of Civil Engineering held in Mexico City were summarized by Ettiene Totti, San Juan engineer, during the technical program presented at a meeting held at the Mayaguez College of Agriculture and Mechanical Arts. Jorge J. Jimenez then presented a discussion of one of the Mexico City papers on highway investigations and planning. Inspection of the building of the Cerveceria Real, Inc., arranged by its president Gabriel C. Soler, brought to a finish the all-day program, which included a luncheon and attendance at the college commencement exercises.

OREGON

STUDENTS PRESENTED PAPERS in a competition for Section prizes of Junior membership in the Society at the annual joint meeting of the Section and the Oregon State College Student Chapter. Awards were made in the following order to: George H. Gothro for his discussion of field methods of waterproofing SR-4 Strain Gages; Harold Peyton, whose subject was "Pumice as a Light-Weight Concrete Aggregate"; and J. R. Libby and D. L. King, who dealt with "Analysis of a Model Truss."

GEORGE H. GOTHRO, of Oregon State College Chapter (left), receives first prize from Theron W. Ragsdale, Oregon Section president, in recent student paper contest.

PROVIDENCE

ARCHITECTURAL CONCRETE was the topic of discussion at a recent meeting, with the leading talk given by Edward B. Oberly, construction superintendent for the Portland Cement Association. Mr. Oberly covered the details of form construction, placing and finishing of the concrete, and types of finishes.

ST. LOUIS

STUDIES FOR EXPRESS highways in the metropolitan area and plans for the Third Street Interstate Expressway through the city were summarized at a recent meeting by Harold L. Lien, division survey and plans engineer of the Missouri State Highway Department. ASCE Past-President W. W. Horner reported on the Spring Meeting of the Society, and Vice-President Robert Brooks assailed pending national legislation that would eliminate engineering from the Army technical services and urged members to write their Congressmen and Senators protesting it. The Section announced that this year its annual awards to outstanding senior civil engineering students will go to Wilbert P. Williams, of Washington University, and Albert B. Hensley, of the University of Missouri.

TRI-CITY

A FIRST-HAND ACCOUNT of the economy of Eastern Europe was given at a recent meeting, held in Muscatine, Iowa, by Dimitriz Nesterenko, an engineer for the Stanley Construction Co., of Muscatine.

SEATTLE

A PROGRAM OF student papers was presented in a prize paper competition at a recent joint meeting of the Section and the University of Washington Student Chapter. The Section's first prize of Junior membership in the Society went to G.T. Orlob, for his paper on "Chlorination of Sewage and Sewage Sludge." Robert Rowse, whose subject was "A Study of Multiple Distributor Beams on Elastic Foundations," and Kenneth Robbins, who discussed temperature effects on soils, tied for second place. Both were awarded $5 gift certificates. During the business session, a resolution recommending changes in the state building code to make it conform to the State Professional Engineers' Registration Act was passed and prepared for transmittal to the proper state authorities.

SOUTHERN IDAHO

TRAFFIC STUDIES WERE described as a prerequisite to successful highway design and location by J. A. Redman, of the Idaho State Highway Department, at a recent meeting of the Southern Idaho Section. The use of aerial photography as an aid in the planning of highway location was demonstrated and recommended. ASCE President Franklin Thomas then reported on Society activities and interests, furnishing detailed information on the present financial situation of ASCE. During his visit with the Section, President Thomas inspected engineering features in the Payette and Boise Valleys, including Arrowrock Dam.

WISCONSIN

THE NEED FOR modernizing the Society's constitution and for establishing a closer relationship between the Board of Direction and the Local Sections was emphasized by Executive Secretary William N. Carey in the feature talk at a recent meeting. As a step in the right direction, Secretary Carey cited the proposed Harrington plan for redistricting. An enthusiastic question-and-answer period followed his talk.

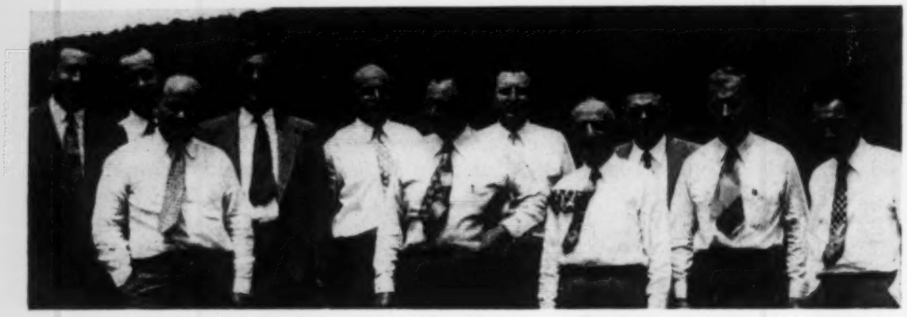
SPOKANE SECTION

PROJECTS UNDER CONSTRUCTION in the Columbia Basin were visited by approximately 200 members of the Spokane Section, the Columbia Branch of the Section, and Student Chapters of the University of Idaho and State College of Washington on a recent field trip. Starting at Ephrata, Wash., the group went north to Coulee Dam, with stops en route at the Soap Lake Siphon and Dry Coulee Siphon, where the powerhouses and pumping plant were inspected. Following dinner at the dam, representatives of the Bureau of Reclamation described various features of the work, including the floating caisson that will be used to repair the spillway bucket, the use of pre-packed concrete, the canal system, and procedures involved in the preparation and execution of contracts for the work.

MEMBERS OF SPOKANE SECTION AND ITS COLUMBIA BRANCH, together with Student Chapter groups from University of Idaho and Washington State College, view spillway at Coulee Dam in recent inspection trip to points of interest in Columbia Basin.

TENNESSEE VALLEY SECTION

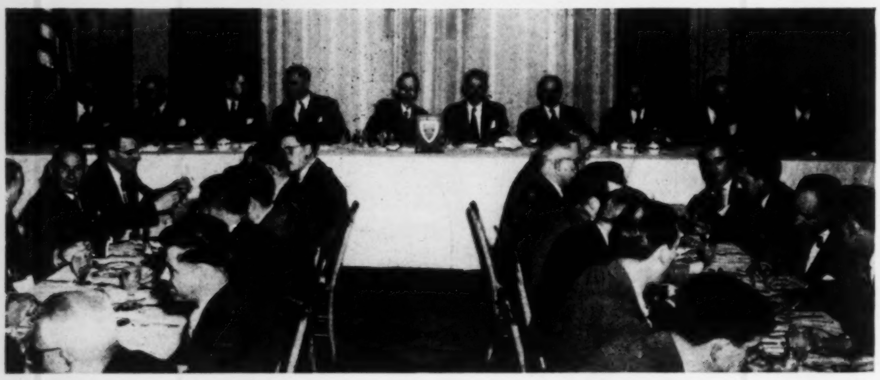
Tours of the Watauga and South Holston Dams featured the two-day spring meeting of the Tennessee Valley Section. Meeting headquarters for the business sessions and social activities was Bristol, Va. Oren Reed, construction engineer for the TVA on the Watauga Project, was chairman of the technical program. Director Edmund Friedman, of District 10, and Don Reynolds, Assistant to the Secretary of ASCE, headed discussion of Society and Section affairs during the business sessions, which were under the chairmanship of Section President E. M. Titus. Toastmaster for the banquet that concluded the first day's program was George Leonard, project manager at Watauga. The featured speaker was Mrs. William A. McCall, who has been active in the development of the educational system and facilities of the Tennessee Valley.



MEMBERS AND GUESTS OF TENNESSEE VALLEY SECTION visit Watauga Dam during recent spring meeting of Section. Shown, left to right, are Don P. Reynolds, Assistant to Secretary, ASCE, New York City; John C. Voorhees, secretary-treasurer, T. V. Section; Don H. Mattern, president Knoxville Sub-Section· Albert S. Fry, chairman, Board of Editors, "Tennessee Valley Engineer"; Ernest M. Titus, president, T. V. Section; Albert B. Goodwin, president, Asheville Sub-Section; Bayard C. Erskin, treasurer, "T. V. Engineer"; Edmund Friedman, Director, District 10; Hugh B. Henry, managing editor, "T. V. Engineer"; George H. Maxwell, president, Holston Sub-Section; and W. Douglas Lavers, president, Oak Ridge Sub-Section.

WEST VIRGINIA SECTION

The flood wall project at Parkersburg, Va., now under construction by the Army Corps of Engineers, was inspected by members of the West Virginia Section at a recent afternoon meeting. Representatives of the Huntington District of the Corps and the E. J. Albrecht Co. conducted the tour, which covered inspection of the completed earth levee sections, the concrete wall sections now in construction, and the general facilities, such as pumping stations and gate openings. The principal speaker at the evening dinner meeting following the trip was ASCE Director Paul L. Holland, director of public works for the City of Baltimore, who presented a paper on municipal engineers and their problems. Mr. Holland also reviewed recent ASCE policies and procedures.



PICTURED AT SPEAKERS' TABLE at recent meeting of West Virginia Section are, left to right, Carl Vogel, resident engineer, Corps of Engineers, Parkersburg; J. B. Hoke, past-president, West Virginia Section; R. E. Life, Parkersburg City Council; Paul L. Holland, ASCE Director, District 6; J. N. Wallace, president, W. Va. Section; S. B. Settle, chairman of committee on arrangements for Parkersburg meeting; the Rev. A. L. Mahr, Parkersburg; F. D. McEnteer, vice-president, W.Va. Section; R. W. Blair, president, Parkersburg chapter, W.Va. Society of Professional Engineers; and K. A. Kettle, Section secretary-treasurer.

STUDENT CHAPTER

STANFORD UNIVERSITY

"Engineering adventures in Wonderland—or Through the Sonic Barrier" was the topic of an address given by Walter G. Vincenti, of the Ames Laboratory, at a recent meeting of the Stanford University Student Chapter. At another meeting, the recently completed report on a second bay crossing was discussed by Ralph Tudor, chief engineer of the Division of San Francisco Bay Toll Crossings. Charles Nichols, a member of the Student Chapter, has been made chairman of the Engineers Joint Council currently organized on the campus to promote closer relations between the different student engineering groups.

UNIVERSITY OF UTAH

What the laws for engineers and architects in the State of Utah mean to the graduate engineer and to the engineering profession was discussed by Carl Christensen, consulting engineer, at a meeting of the University of Utah Student Chapter. Prof. A. Diefendorf, head of the Engineering Department at the university, spoke on the subject of "Utah State Board of Registration," giving a clear-cut picture of the requirements, type of examinations, and reasons why an engineer should be licensed to practice in the state. Professor Diefendorf is chairman of the Utah State Board of Registration for Professional Engineers and Architects.

VIRGINIA POLYTECHNIC INSTITUTE

Techniques used on some of the major projects on which he was engaged as contractor were summarized by C. A. Albert, private contractor, at a recent meeting of the Virginia Polytechnic Institute. E. L. Coil, field engineer, Portland Cement Association, supplemented Mr. Albert's talk with demonstrations and comments on recent improvements in the field of reinforced concrete.

UNIVERSITY OF SANTA CLARA

New university of Santa Clara Student Chapter officers, elected at a social meeting recently, include: Paul D. Smith, president; Richard C. Caletti, vice-president; John M. Stewart, treasurer; Robert L. Towne, corresponding secretary; and James E. Brinckley, recording secretary.

UNIVERSITY OF NEVADA

Observations of the Fukuii earthquake in Japan were given in an address by H. J. Brunnier, San Francisco consultant, at an afternoon meeting of the University of Nevada Student Chapter. Various structural failures caused by the earthquake were shown by slides. Students, faculty members, and local engineers were among the 120 persons in attendance. At the evening session, Mr. Brunnier gave practical hints to young engineers starting out in the profession. At another recent meeting Fred Paget, senior hydraulic engineer for the California Division of Water Resources, spoke on "California's Liquid Assets."

UNIVERSITY OF TEXAS

Problems encountered in the design and construction of buildings at Houston, Tex., were presented in a talk on welded building construction before members of the University of Texas Student Chapter by W. H. Greer, of Southwestern Laboratories. Mentioning that Houston has 108 stories of welded construction in large as well as small structures, Mr. Greer pointed out that the City National Bank is the largest in floor space and height in the world to have this type of construction. The following officers were elected for the spring semester: Clarence Handley, Jr., president; John Viehweg, vice-president; and Hugh M. Farmer, treasurer.

NEWLY ELECTED OFFICERS of University of Colorado Student Chapter include (front row, left to right): Robert Swanson, treasurer; Richard E. Davis, president; and Leo C. Novak, Faculty Adviser. In back row are Erwin J. Bell, vice-president, and Robert W. Meigs, secretary.

GEORGE WASHINGTON UNIVERSITY Student Chapter members are photographed with Assistant Dean Carl H. Walther, Faculty Advisor (center, in front row), Mr. Alexander (right), and Mr. Repass (left), Washington, D.C., contractors, guides on inspection tour of Whitehurst Memorial Freeway on K Street in Washington.

OREGON STATE COLLEGE

Increased efficiency in construction, maintenance, and operation of our motor vehicle transportation system was discussed by city, county, and state officials and West Coast industrialists during the six technical sessions of the First Annual Roads and Streets Conference sponsored jointly by the Oregon State College Student Chapter and Department of Civil Engineering and held on the campus at Corvallis. Considerable attention was attracted by a three-dimensional traffic flow map of Oregon state highways and a large-scale model of the proposed Sullivan's Gulch Freeway development at Portland. Student Chapter president John S. Boyle was chairman. Newly elected Chapter officers are David Koester president; Don Hoggat, vice-president; Joe Devlin, secretary, and Duane Lent, treasurer.

MEMBERS OF OREGON STATE COLLEGE STUDENT CHAPTER and Civil Engineering Department are joint hosts to large group of West Coast public officials and industrialists at two-day Roads and Streets Conference, held on college campus at Corvallis. Other sponsors were League of Oregon Cities, Association of Oregon County Engineers, Oregon State Highway Department, and Pacific Coast division of Asphalt Institute.

NEWS BRIEFS

New Construction in May Increases 15 Percent Over April Total

Construction activity in May was valued at $1.6 billion, a seasonal increase of $200 million over April, according to a U.S. Department of Commerce release. With this 15 percent advance, total new construction equalled that of May 1948. This increase is attributed chiefly to a rise of 19 percent in public construction for the month to a total of $457 million, 31 percent above the total for last May. All types of public work, except military and naval construction, shared in the current advance, with highway work increasing by 50 percent. School and hospital building programs have also made a large contribution to the expansion of public construction activity, as compared with last year.

Despite the fact that private home building, exclusive of farms, was valued at $530 million in May, an increase of 20 percent over the April estimate, it was still 15 percent below the level of a year ago, according to joint estimates of the Departments of Commerce and Labor. The downward trend in industrial construction continued in May. Though the value of work on new stores, restaurants, and garages rose seasonally by 15 percent, it remained 15 percent below the level of a year ago. Most other types of non-residential building were running well ahead of a year ago, after seasonal increases in May.

The $6.6 billion total of new construction put in place during the first five months of the year was 3 percent above the total of $6.4 billion for the corresponding period of 1948, largely because of increased public construction, according to the Department of Commerce Construction Division. Privately financed construction dropped 6 percent during the period, while public expenditures for new construction were 40 percent greater than for the same period in 1948. Similarly, the total value of residential construction put in place during the first five months of 1949 was 15 percent below the total for such work through May last year.

Production of building materials in March exceeded the February total by 18 percent, with the output of 15 of the 20 materials listed in the Department's monthly index of production showing gains over the previous month. The production of nails and concrete reinforcing bars reached new high postwar levels. However, the output of plumbing and heating equipment showed a drop from the February figures, reflecting adjustment of supplies to demand. Over-all production of building materials during the first quarter of the year was approximately 11 percent below that of the first quarter of 1948.

New construction activity by regions discloses no major change in the pattern prevailing since the end of the war. Again in first place was the East North Central Region, which accounted for 18.9 percent of the national total. The Pacific Coast states placed second, with 16.9 percent of the national total, while the Middle Atlantic Region was third with 15.6 percent.

◆

Engineering Progress in Highway Safety Reported at President's Conference

Notable progress in engineering aspects of highway safety has been made in constructing the highway plant, in the performance of existing traffic facilities, and in provision of new and safer vehicles, according to a report of the Committee on Engineering presented at the second annual President's Highway Safety Conference, held in Washington, D.C., June 1–3. The report pointed out that state highway departments are becoming better organized to meet operational problems, with 42 states having traffic engineering divisions. Of the 158 cities of more than 50,000 population reporting, 69 now have a traffic engineer—a gain of seven over 1947. Smaller cities, too, are tending more and more to apply engineering training to traffic operations.

Recommendations of the Committee on Engineering call for continuous programs of publicity, education, and law enforcement; coordination of traffic-operation and safety activities; closer cooperation between motor-vehicle manufacturers, road builders, and operations engineers; emphasis on traffic safety in land development and urban planning; expansion of the present cooperative surveys conducted by the states and the federal government with a view to developing long-range improvement programs; staffing of official agencies and boards concerned with highway engineering problems with engineers; more attention to safety considerations at the design stage of highways and vehicles; and continued recording and analysis of accident data.

The report also emphasized the necessity for study of roads and streets to detect possible hazards and elimination of hazards by local engineering treatment, whenever possible; acquisition of sufficient right-of-ways to meet modern construction demands; improvement of secondary roads and streets; elimination of highway and railway grade crossings and adequate protection of railway grade crossings when elimination is not feasible. In many states railroad grade separations are built on new right-of-ways adjacent to the old crossings, which remain unclosed because of lack of legal authority. The Committee on Engineering took action to draft model legislation that would facilitate closing such crossings.

Also included in the Committee's agenda were recommendations for further study of polaroid headlights for motor vehicles; uniformity in roadway signs and marking and in vehicle lighting devices; plans for off-street parking facilities as the ultimate solution to the traffic problem and maximum utilization of curb parking space; more use of modern highway lighting and all-weather sidewalks and other facilities to reduce night accidents and pedestrian fatalities; application and enforcement of speed zoning; limiting of vehicle size and weight in accordance with AASHO standards; and statutory periodic inspection of motor vehicles.

Weak spots in application of the Action Program of the Conference were the focus of attention throughout the three-day conference. More than 2,500 public officials representing every state and many municipalities heard President Truman in his keynote address express disappointment "at the failure of many states to establish driver-licensing regulations worthy of the name." Another deficiency noted by the President was in the collection and use of accident reports, which he called "fundamental to the entire highway program."

In opening the Conference, Maj. Gen. Philip B. Fleming, M. ASCE, newly appointed chairman of the U.S. Maritime Commission and general chairman of the Conference, cited the success of the Action Program. Suppose, he said, there had been no Action Program and the fatality rate had remained at its pre-Safety Conference level, "last year's death toll on our streets and highways would have reached 48,000 instead of 32,000. Partial failures," he added, indicate that "the program has not spread far enough into the grass roots. Too many rural areas and small towns have neglected or slighted essential features of this life-saving work."

Executive Secretary William N. Carey represented the Society at the Conference. Presiding officer was ASCE Honorary Member Thomas H. MacDonald, chairman of the PRA. The Committee on Engineering is headed by Gibb Gilchrist, M. ASCE, chancellor of Texas A. & M. College, as chairman and Andrey A. Potter, dean of the Purdue University Engineering Schools, as vice-chairman.

Truman Bridge Across Missouri Receives AISC Award

HARRY S. TRUMAN BRIDGE, spanning Missouri River at Kansas City, recently received Class IV award of American Institute of Steel Construction for 1945. Though structure was opened to traffic in 1945, it is honored only now because of wartime suspension of AISC award program. Bridge was designed by Howard, Needles, Tammen & Bergendoff, and fabricated by American Bridge Co. for Rock Island System and Chicago, Milwaukee, St. Paul & Pacific Railroad.

New Generator Increases Grand Coulee Power Output

A NEW 108,000-KW GENERATOR, recently put into service at Grand Coulee Dam by telegraphic impulse from the White House, makes the project the greatest single producer of power in the world. With a rated capacity of more than 1,100,000 kw, Grand Coulee could meet the combined power needs of two cities equivalent in size to Washington and Baltimore. The huge new generator, tenth in a series of 18 being built for the project by the Westinghouse Electric Corp., is 45 ft in diameter and 32 ft high. The total power output of 1,944,000 kw from the 18 generators, which are scheduled for completion in 1951, will exceed the capacity of the Dnieper Dam in Russia by more than 300 percent.

President Truman conducted the White House ceremonies, which were witnessed by Department of the Interior officials and members of Congress. At Grand Coulee, the presiding official was Frank A. Banks, Assoc. M. ASCE, district manager for the Bureau of Reclamation.

◆

Expansion of Newark Airport Is Announced

A $20,000,000 FOUR-RUNWAY plan for expansion of Newark Airport, which will give it a peak capacity of 120 planes an hour—equal to that of the New York International Airport at Idlewild—has been announced by the Port of New York Authority. The runways, ranging in length from 6,000 to 9,000 ft, will be designed to handle transport planes weighing 150,000 lb. The plan also provides for a terminal area that can be approached by surface roadway from Route 25 without an expensive underpass, and gives maximum space for construction of hangars, cargo terminals, and other essential airport facilities.

The Port Authority is also completing plans for expansion of the present terminal building at the airport.

◆

ECA Sees Rapid Recovery of European Transportation

RECOVERY OF WESTERN Europe's transportation system has been so rapid the Marshall Plan will be able to work on a reduced budget next year, according to a recent release from the Economic Cooperation Administration. Tentative figures submitted by Marshall Plan nations indicate that dollar requirements for procurement of transportation equipment in the 1949–1950 fiscal year will be less than the $140,000,000 authorized in the first year of the European Recovery Program.

According to the ECA, the Netherlands now has more trucks than in 1938—about 34,000 in comparison with the prewar figure of 28,000. France also is reported to have more trucks than before the war, largely as a result of increasing its own production from 71,100 trucks in 1947 to 177,346 in 1948—double its 1938 production. Present ECA plans call for the expansion of Western Europe's truck fleet by 1,000,000 vehicles between now and 1952.

A marked improvement in railroad operations is indicated by the fact that although the number of freight cars is about 10 percent below the prewar level—with much of the rolling stock unserviceable—railroads are hauling more tonnage than they did in 1938. Direct ECA aid to Western European railways has been limited chiefly to equipment and raw materials, though France is now assembling 2,500 freight cars received from the United States. The ERP machinery and raw materials will permit the production of additional rolling stock and the repair of tracks and rails. An intensive repair program is also under way for inland water transport, which has suffered seriously from the loss of tugs, barges, and other craft.

◆

Poor Highways Called Threat to Our Economy

INITIATION OF "THE largest highway program in history" as a remedy for the present poor condition of our roads resulting from the war and as a stabilizing element in the national economy was urged by Charles M. Upham, M. ASCE, engineer-director of the American Road Builders Association, in an address before an audience of 500 at the 27th annual meeting of the West Virginia Contractors Association in Charleston.

Calling for "an awakening to the crying need for highway improvement at this time," Mr. Upham stated that "Even in the depression years, the average volume of highway work accomplished was higher than that done in any year since the war. The postwar program in theory should take care of our augmented traffic of 10,000,000 additional motor vehicles registered since the war's end and an increased population of 25,000,000 since 1930, but it has yet to equal the construction of the immediate prewar years. The current devaluation of the highway dollar is one reason why we are so far behind in our national road building," he explained. "While we have spent $3^1/_2$ billion on our highways since the end of World War II, in terms of 1939 dollars, we have only about half that much work to show for it," he said. This condition must be considered in all future planning, he emphasized.

◆

Iron and Steel Export Markets Show Changes

NUMEROUS CHANGES OCCURRED in export markets for iron and steel from the United States in 1948, according to an announcement from the American Iron and Steel Institute. For the first time since 1939, the largest share of the exports went to countries in North and Central America and the West Indies. South American countries ranked second. Europe, for eight consecutive years the largest consumer of steel exports from the United States, dropped back to its prewar position of third largest market. Asiatic countries, which received the largest percentage of iron and steel exports between 1935 and 1939, were the fourth largest market last year. Africa continued to rank fifth, and Australia as in the past received the smallest part of the exports.

According to final Department of Commerce figures, 1948 exports of iron and steel from the United States amounted to 4,697,405 tons.

Snow and Hydrology Groups Have Large Joint Meeting

Results obtained in the cooperative snow research program of the Corps of Engineers and the U.S. Weather Bureau were described at a recent three-day joint meeting of the Western Snow Conference and the Hydrology Section of the American Geophysical Union, in Denver, by Forrest L. Rhodes and Walter T. Wilson, Associate Members ASCE. Speaking for the Corps of Engineers and the Weather Bureau, respectively, the authors emphasized the technical progress being made in the cooperative investigations. Present studies dealing with development of a radio transmitting, receiving, and recording system may make possible automatic measurement at remote points of snow-water equivalent through the use of radioactive-cobalt and Geiger-tube circuits, they said.

A paper on "Anchor and Frazil Ice," by Maj. R. C. Farrow, was discussed by Ralph L. Parshall, M. ASCE, emeritus senior irrigation engineer of Colorado A. & M. College. Other authors of papers on snow problems included D. N. Stewart, maintenance engineer for the Colorado State Highway Department; Walter U. Garstka and Phyllis Peasley, hydraulic engineer and mathematician for the Bureau of Reclamation; B. C. Goodell, conservationist for the Rocky Mountain Forest and Range Experiment Station; and Prof. C. C. Warnick, of the University of Idaho.

A correlation between infiltration rates indicated by field infiltrometer tests and retention as indicated by studies of storm rainfall vs. streamflow for the same area was shown by Paul Leatham and H. S. Riesbol, M. ASCE, of the Hydrology Division of the Bureau of Reclamation, in a leading paper on the hydrology program. Other papers on hydrological subjects were presented by A. R. Croft, of the U.S. Forest Service at Ogden, Utah; Archie Kahan, of the U.S. Weather Bureau at Kansas City; Stanley Miller, of the U.S. Engineer Office at Denver; Kenneth R. Melin, of the U.S. Geological Survey at Billings, Mont.; and Satnarayan Singh, of Colorado A. & M. College.

Tours of the Colorado-Big Thompson transmountain diversion project and the engineering laboratories of the Bureau of Reclamation concluded the joint conference, which was attended by more than 200. Ralph Parshall was general chairman of the Western Snow Conference and Herbert S. Riesbol, of the meeting of the American Geophysical Union.

◆

Army Approves Building of Narrows Suspension Span

Plans for construction of a six-lane, 6,540-ft suspension bridge across the Narrows in New York Harbor have been given final military approval by Acting Secretary of the Army Gordon Gray and Maj. Gen. Lewis A. Pick, chief of Army Engineers. These plans, which were submitted by the Triborough Bridge and Tunnel Authority of New York City, provide for a vertical clearance of 237 ft at the center of the bridge and a clear span of 4,620 ft between towers, making it the longest suspension bridge in the world. Linking Staten Island and Brooklyn, the structure will provide a direct route from New England and Long Island to the South and West without crossing congested Manhattan.

Present estimates put the cost of construction at $78,000,000, which the Bridge and Tunnel Authority will attempt to raise by bond issue. However, it is doubtful if such arrangements can be worked out before the Authority's present major project, the Brooklyn-Battery Tunnel, is completed a year from now. After that, at least three years will be required for building the bridge.

◆

AEC to Expand Research Facilities at Oak Ridge

A $19,000,000 construction and improvement program at the Oak Ridge, Tenn., national laboratory has been announced by the Atomic Energy Commission. Expansion of the laboratory, which will require about two and a half years, involves construction of 205,000 sq ft of new buildings, renovation of 15 structures, and improvement and extension of existing roads and plants. Most of the laboratory research work is now conducted in temporary quarters.

The present program will supplement a $70,000,000 program for expansion of the half-billion-dollar gaseous diffusion atomic process plant at Oak Ridge, announced by the AEC in January.

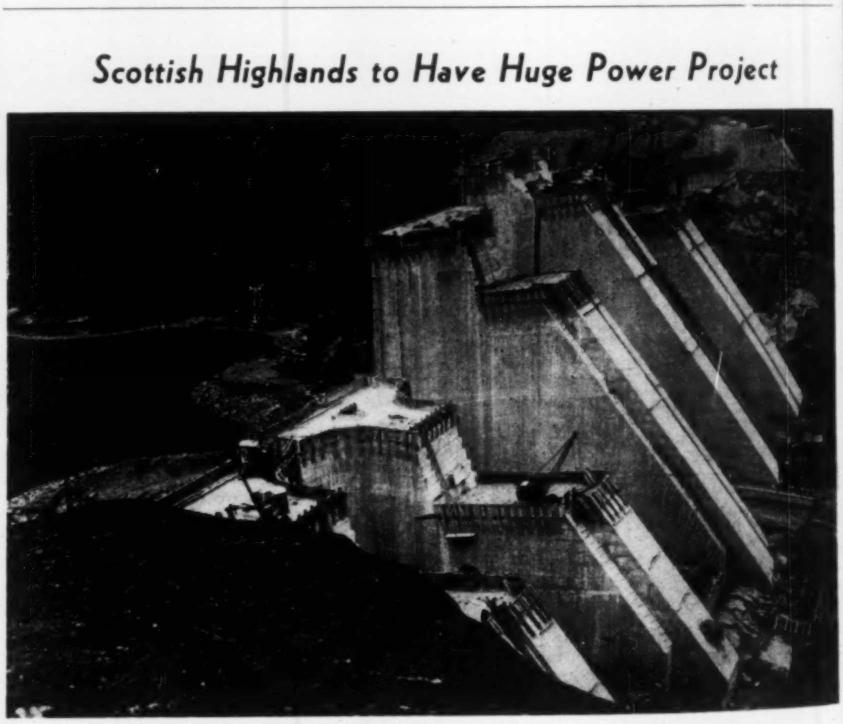
◆

Flood Control Costs Put at More Than Seven Billion

The national flood control program includes nearly 1,000 projects, with an estimated cost of $7,503,000,000, according to Maj. Gen. Lewis A. Pick, chief of Army Engineers. Reviewing the work of the Corps of Engineers before a recent hearing of the House Public Works Committee, General Pick stated that the program is "probably the largest single construction program in the entire world." To date, he said, Congress has authorized projects that would cost $3,590,000,000.

In the ten years between 1938 and 1948, General Pick reported, 256 projects were completed, and 30 more will be finished this year. Pointing out that the cost of these projects has thus far been $483,000,000, he stated that, "Our estimates, which we believe to be conservative, show that these works have prevented damages in excess of $500,000,000, so the projects have already paid for themselves."

Scottish Highlands to Have Huge Power Project



GIANT HYDROELECTRIC POWER PROJECT, designed to produce nearly 1,700 million kwhr of electricity annually, is under construction in Scottish Highlands west of Loch Lomond. Photograph shows buttress formation of 1,200-ft dam at Loch Sloy, which will impound reservoir of 1,200 million gal and have annual power output of 230,000,000 kwhr. Water will be carried by pipes tunneled through Ben Vorlich Mountain to power plant at Loch Lomond. When completed, entire project will have power output equal to almost half present consumption of Scotland and is expected to bring new industries to Highlands and open remote areas to tourists.

Model Freeway Now in Service in San Diego Area

RECENTLY COMPLETED, FOUR-LANE CABRILLO FREEWAY IN CALIFORNIA, extending 7.1 miles from San Diego to connect with U.S. Highway 395, is considered model of freeway construction. Built at cost of $3,500,000, project involved construction of two bridges and 13 grade separations and considerable relocation of city utilities. Pascoe Street overcrossing, pictured here, shows new plantings of shrubs and cocopalms which will increase beauty of freeway and prevent erosion on new cuts.

Great Britain Develops Engineering Projects in Africa

As PART OF an extensive program for developing her African colonies, Great Britain is sponsoring numerous engineering and agricultural projects there, according to a recent industrial bulletin of Arthur D. Little, Inc. Engineering developments include a hydroelectric project near Victoria Falls and a dam at Kariba Gorge, larger than Hoover Dam. Another hydroelectric project will be undertaken by the governments of Uganda and Egypt at Owen Falls, at the source of the Nile. Other governments may later join a scheme to develop and control all the sources of the Nile.

As a preliminary step to laying out a communication system, the Royal Air Force is surveying over 150,000 sq miles of the continent, much of it unexplored. An intercolonial transportation route is being jointly investigated by Britain and France. Extension of the present route from French Equatorial Africa to the Sudan was mapped during the war, but equipment for construction was not available. Plans are also being made for development of the Cape-to-Cairo route. Though the British completed a road linking the Nile Valley and the Congo River Valley in 1943, it can accommodate only limited transportation. The completed route includes 2,100 miles of rail, 400 miles of road, and 200 miles of river travel, involving 13 portages. Railroads linking the industrial areas of South Africa with the sources of raw materials in East Africa are being planned and will be built, if financial assistance can be obtained from America.

Agricultural developments include the establishment of research stations that will aid local agriculture, and the use of new drugs that are reported highly effective in fighting sleeping sickness in cattle. Previous plans for clearing selected areas of sleeping sickness by eliminating the tsetse fly through destroying vegetation, clearing swamps, and spraying with insecticides have been successful, though costly.

A plan, known as the "Groundnuts Scheme," begun last year in Tanganyika and scheduled to take at least six years for completion, is expected to furnish 600,000 tons of peanuts annually by building a series of farms from over 5,000 sq miles of brush-covered waste land. When completed, the plan will increase the per capita ration of oils and fats in Great Britain by 35 percent. Africa is the world's largest exporter of peanuts and peanut oil. The meal left after the oil is extracted has a high protein content and is valuable as cattle feed. Though the initial cost of the plan is over $100,000,000, the present shortage of fats and oils made the first crop produced under the plan highly profitable, and the enterprise is expected to pay for itself ultimately.

◆

Drop in Construction Costs Is Predicted

BUILDERS, IN GENERAL, expect a decline in construction costs during the remainder of the current building season, according to a recent survey of the industry conducted by the F. W. Dodge Corp., fact-finding organization for the construction industry. The survey shows that building costs for both single-family houses and large buildings, in the nation as a whole, decreased 5 percent between May 1, 1948, and May 1 of this year. The group also predicts that by November of this year costs will have dropped 8 percent more.

While three out of ten builders questioned report adequate supplies of all materials and equipment, the remaining 70 percent are still hampered in their work by shortages of one or more of the metals, metal products, masonry materials, or lumber and millwork materials.

About 25 percent of the group reported that no materials continue at peak level or are continuing to rise, while the remaining 75 percent find one or more items, particularly in the metals and metal products group and in the masonry materials group, are at their peak or continuing to rise. A definite improvement in two factors has been noted—namely, the excessive time required in shopping for and obtaining materials, and irregular deliveries of materials. Both of these factors were important cost-inflation elements in the immediate postwar years.

The group was almost unanimously agreed that productivity per man hour of on-site building craftsmen has improved during the past year—about 10 percent, in the opinion of most of the builders. Further improvement in productivity of both skilled and unskilled workers during the remainder of the year is expected.

Lump-sum contract letting has returned as general practice in the construction industry, the builders indicate, with 72 percent reporting that three-quarters or more of their current work is being done under firm-bid contracts. During the immediate postwar period of soaring costs, many builders were accepting only cost-plus-fixed-fee contracts in order to protect themselves against losses on work done.

◆

Boston Society of Civil Engineers Honors Members

SEVERAL ASCE MEMBERS were awarded prize and medals at the recent 101st annual meeting of the Boston Society of Civil Engineers for especially notable contributions to its publications during the past year. These were Thomas R. Camp, member of the Boston consulting firm of Camp, Dresser & McKee, who was awarded the Desmond FitzGerald Medal; John R. Babcock, 3d, professor of railway engineering at Massachusetts Institute of Technology, winner of the Clemens Herschel Award; and Robert J. Hansen, associate professor of civil engineering at M.I.T. George R. Rich, engineer for Charles T. Main, Inc., and Charles M. Anderson, deputy engineer for the Massachusetts Land Court, received technical section awards of books.

New BSCE officers elected for the coming year include Society members Harrison P. Eddy, Jr., president; Thomas R. Camp and Prof. John B. Wilbur, vice-presidents; and Herman G. Dresser, treasurer. Robert W. Moir, senior civil engineer for the Metropolitan District Commission, is secretary.

Prof. Wilbur M. Wilson Awarded Marston Medal

Wilbur M. Wilson, research professor of structural engineering at the University of Illinois and former ASCE Director, was named the eleventh winner of the Marston Medal "for achievement in engineering" at the recent 78th annual commencement exercises at Iowa State College.

Wilbur M. Wilson

An alumnus of Iowa State and of Cornell University, Professor Wilson taught at Iowa State before going to the University of Illinois in 1913. A specialist in the determination of fatigue strength of structural members subjected to repetition of loads, Professor Wilson has received many honors for his writings on structural subjects, including the J. James R. Croes Medal of the ASCE. He was a Director of the ASCE from 1944 to 1947 and represented the Society at the atomic bomb tests at Bikini in 1946.

The Marston Medal established by Iowa State College through the generosity of Anson Marston, ASCE Past-President and dean emeritus of the Iowa State College division of engineering at the time the award was created in 1938, is given annually to an engineering alumnus of the college in recognition of achievement.

◆

Members Receive Prizes in AASHO Essay Contest

Emmett H. Karrer, Assoc. M. ASCE, professor of highway engineering at Ohio State University and former secretary-treasurer of the Ohio Section, is top winner in the Faculty Division of the 1949 national essay contest of the American Association of State Highway Officials, according to a recent announcement from the AASHO. Winner of the Student Division is Michael Lash, Jr., member of the ASCE Student Chapter at Tufts College, and a Marine Corps veteran.

Selected for honorable mention in the Faculty Division were Prof. R. A. Marr, Jr., M. ASCE, of Virginia Military Institute; Prof. Ellis Danner, Assoc. M. ASCE, of the University of Illinois; and Prof. L. J. Ritter, Jr., Jun. ASCE, of the University of Florida. In the Student Division, honorable mention went to Kenneth H. Latham, of the University of Idaho; David C. Koester, member of the Oregon State College Student Chapter; and Joseph W. Williams, member of the Lafayette College Student Chapter.

Topics for the essays, on which the competition was based, were "What I Advise My Students with Regard to Highway Engineering" for the Faculty Division, and "What I Think of Highway Engineering as a Career" for the Student Division.

PRA Official Urges Completion of Inter-American Highway

Completion of the Inter-American Highway will benefit the United States in many ways, according to Edwin W. James, M. ASCE, chief of the Inter-American Regional Office of the Public Roads Administration. In an article in a recent issue of *Road Builders' News*, publication of the American Road Builders' Association, Mr. James stated that the highway, when finished, will provide a line of overland communication from continental United States to the Panama Canal useful in both peace and war. Even more important, he declared, completion of the project will afford the United States an unparalleled opportunity to create inter-hemisphere solidarity by extending help to less developed countries.

Figures given by Mr. James show that, at the present time, 1,660 miles, or 51 percent, of the 3,260-mile route between Laredo, Tex., and the Panama Canal is paved, largely with a bituminous surfacing. Another 932 miles, or 29 percent, though not yet paved, are passable in all weather. In addition, 361 miles, 11 percent, are passable in dry weather, leaving only 308 miles of unimproved and largely impassable trails.

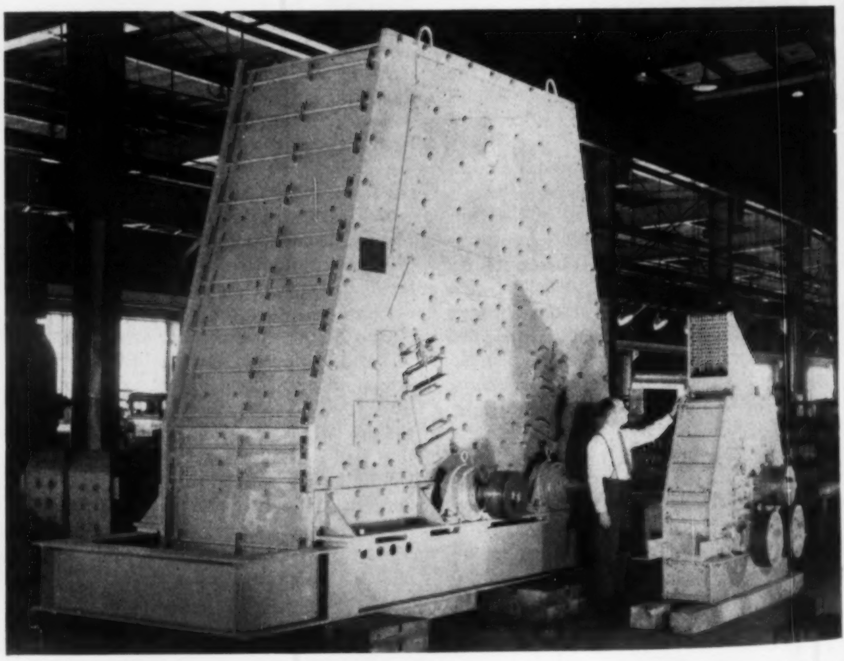
The 308 miles of trails, constituting the remaining 9 percent of the total route, account for three gaps in the highway. One of these gaps crosses the Mexico-Guatemala frontier, with approximately 50 miles on the Mexican side and 35 miles on the Guatemalan side. The other two gaps, of 90 and 130 miles, are in Costa Rica.

The Mexican government, which has financed and built all of the route within its boundaries, expects to open the highway to traffic as far as the Guatemala frontier during the present year, and work on the 35-mile gap in Guatemala is financed and now under way. Construction of this northern gap will leave only about 220 miles in Costa Rica to be opened to traffic in order to make the road usable throughout its length.

Stating that the Inter-American Highway has become the backbone of a valuable road system, Mr. James pointed out that Central American countries are using their own funds to build feeder roads. "All of the countries have become road-minded in ways that count," he added. "With the main road still incomplete, every country has with its own resources constructed a substantial mileage of tributary roads. The Mexican government has adopted a program of grants-in-aid to the several Mexican states much like the federal-aid system in the United States. Guatemala, El Salvador and Costa Rica have financed and constructed both bridges and highways to make or extend connections with the Inter-American Highway into areas previously without adequate highways.

"With the termination of financial aid by the United States Nicaragua continues to spend $30,000 a month. Honduras has just raised for the Inter-American Highway an allotment equal to $9,000. El Salvador is continuing construction as rapidly as local funds permit."

In other countries, notably Costa Rica, work is at a standstill because local funds are not available, Mr. James noted, stating that "All these countries look hopefully to the United States for assistance on the project."



WORLD'S BIGGEST STONE CRUSHER, Model 5050 announced in January, is photographed beside new midget Model 1212, smallest ever made for producing crushed stone by breaking it while in suspension. Midget model, weighing 4 tons and taking stone up to 12 in. in diameter, is designed to take up breaking job after Model 5050 cuts boulders down to its size. Model 5050 weighs 54 tons and handles rock up to 50 in. in size. Both operate with two whirling impellers that catch incoming stone and smash it against breaker bars. New Holland Manufacturing Co., Sperry affiliate, makes both models.

Stabilized City Streets at 6500 Square Yards DAILY!

with a P&H SINGLE PASS SOIL STABILIZER

P&H Stabilizer on Crowley, La. project. Fewer pieces of auxiliary equipment are needed with the P&H Stabilizer, less supervision required. For use in all six of these soil classifications: A-1, A-2, A-3, A-4, A-6 and A-7.

FACTS ON CROWLEY STREET JOB

LOCATION—Crowley, Louisiana.

EXTENT OF PROGRAM—Total of 125,000 sq. yds. of soil cement stabilized sub-base for streets, 20 and 22 feet wide, processed to a depth of 6 inches.

TYPE OF MATERIAL—A-4 soil.

STABILIZING AGENT — Cement, 12% by volume.

RATE OF PRODUCTION — Up to 7,140 sq. yds. per day with average of 6,563 sq. yds.

The surprising economies in time and cost made possible by the P&H Soil Stabilizer are not limited only to country highway construction.

Take the case of Crowley, Louisiana. This city, like others confronted with mounting costs and strained budgets, found its solution in the P&H Stabilizer. With 125,000 sq. yds. of street surfacing scheduled, a single P&H Stabilizer is operating at a daily average rate of over 6500 sq. yds. And this *includes* the unproductive time required to move the machine from one location to another — often after processing as little as one block.

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With definite predetermined results, it shaves and pulverizes the in-place materials, blends, maintains true sub-grade, applies liquid, final mixes, and spreads to a uniform depth—and does it rapidly.

In the few years since its announcement, the P&H Stabilizer has made important savings on hundreds of jobs everywhere. It is because this *one* machine performs all stabilizing operations, soil cement or soil bituminous, in *one* pass and with *one* operator that it makes road building dollars buy so much more.

If you are engaged in the construction of secondary highways, streets, base courses, airport runways, etc., you should have the facts on this machine. *Write today!*

See the P&H Stabilizer in action on soil cement and soil bituminous jobs. Ask about seeing color and sound motion pictures.

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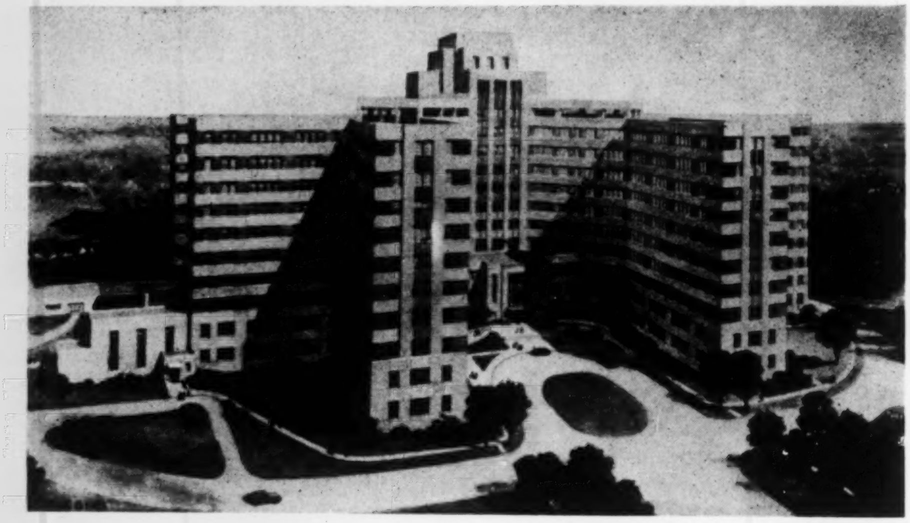
Army and VA Conduct Large Hospital-Building Program



TYPICAL OF VETERANS' HOSPITALS NOW BEING BUILT in big construction program, conducted jointly by Corps of Engineers and Veterans Administration, is this $18,000,000 hospital nearing completion on 26-acre site in Albany, N.Y. Location near city medical center will ensure immediate availability of best medical talent. Exemplifying ultra-modern construction features, ten-story structure of brick and limestone will provide complete treatment and recreational facilities for 1,000 patients, and living quarters for staff and visitors. Cruciform layout is designed to achieve maximum of efficiency through centralization of service facilities. Scheduled for completion in June 1950, entire project is under supervision of Maj. John McClure, of Army Corps of Engineers. Albany hospital is one of 91 slated for construction in government program designed to make total of 140,000 beds available to veterans.

Albuquerque Undertakes Detailed Traffic Study

ALBUQUERQUE, N. MEX., has launched a seven-phase traffic study in an effort to solve both its immediate and long-range traffic problems. The study, which will require a year, will cover the present traffic administration, use of existing facilities, development of a system of arterial streets, parking, truck routing and terminals, investigations of mass transportation, and a comparison of local ordinances with model municipal ordinances.

Cooperating organizations in the survey will be the city, the state, the Public Roads Administration, and the Automotive Safety Foundation. D. Grant Mickle, M. ASCE, director of the Traffic Engineering Division of the ASF, will be in general charge of the study, and the development of a master street plan will be handled by G. Donald Kennedy, M. ASCE, ASF vice-president.

◆

Water Supply Board Expands Field Force

THE BOARD OF Water Supply of New York City is now advertising for bids for the East Delaware tunnel, a 25-mile pressure tunnel deep in rock. The inlet and outlet portions are to be driven from single headings, and the center portions from two shafts at depths of 605 and 965 ft.

For proper supervision of this work, the Board of Water Supply must immediately expand its organization and will need at least 110 men in the titles of Junior Civil Engineer and Assistant Civil Engineer. Appointments are now being made. For details see "Positions Announced" (page 66).

◆

CARE to Aid in Sending Technical Books Abroad

TECHNICAL AND SCIENTIFIC books may be contributed to war-devastated libraries and universities abroad through the medium of CARE, a non-profit agency that has been active in sending food overseas. Libraries and educational institutions in 14 afflicted countries are being asked to give a list of their book needs to CARE, which will fill needs as closely as possible by purchase of the best books obtainable in the specified fields in the United States. Contributions to cover the cost of this service are solicited. They should be sent to CARE headquarters, 20 Broad Street, New York City, or to any CARE outlet throughout the country.

The plan is being carried out with the endorsement and cooperation of the U.S. Commission for UNESCO, the Library of Congress, the American Library Association, and the U.S. Book Exchange.

Steel Output for May Above 1948 Production

WITH A PRODUCTION of 7,683,428 tons of steel in May, the industry exceeded its 1948 output by 103,000 tons, and achieved the second highest tonnage ever made in the month. The highest tonnage ever made in May was 7,702,578 tons in 1944. Steel-making furnaces were operated at an average of 94.1 percent of capacity during May 1949, which was the average of operations for the entire year of 1948.

The industry's output of 39,521,000 tons in the first five months of the current year also established a record. In the twelve consecutive months ending May 31, production exceeded 92,300,000 tons, an achievement never before equalled in a like period.

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

THE RISE IN building costs during and since the war has been well in line with the rise in prices and consumer income generally. The rise for all construction, according to the Department of Commerce composite of several indexes, was 112 percent from 1939 through 1948. The increase in residential construction costs in the same period, according to the widely used 20-city index of E. H. Boeckh and Associates, was 114 percent.

These increases are in line with the rise in wholesale prices of all commodities—114 percent from 1939 through 1948. Prices of wholesale building materials are included in the all-commodities index, and their rise has been 120 percent.

The price rise in building materials may be compared with other components of the Bureau of Labor Statistics wholesale price index. Farm products have risen 188 percent; raw materials, 154 percent; semi-manufactured goods, 103 percent, and manufactured goods, 98 percent.

Since building materials production extends from the processing of raw materials to final factory products, it is to be expected that their price rise would fall somewhere in between that of raw materials and that of manufactured goods. That is the way it has happened.

It is noteworthy that residential construction costs have resisted the shock of unprecedented demand for housing with a rise no greater than that of all commodities, many of which experienced a much more modest increase in demand.

If we measure this rise in housing costs against the purchasing power of housing consumers, we find that average wage and salary incomes for urban families increased 122 percent in the period from 1939 to 1947 and that for rural nonfarm families—those living in small suburbs, in small towns, and in isolated settlements—the family income rise has been 172 percent.

Generally speaking, the average family was better able to buy a new house in 1948 at 1948 costs than in 1939 at 1939 costs.

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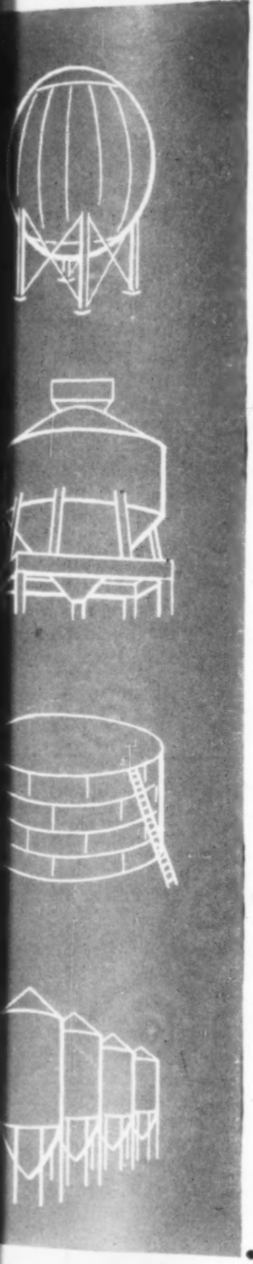

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Bid Openings Announced by Corps of Engineers

BID OPENINGS HAVE been set for several large Corps of Engineers construction projects, according to an announcement from the Office of the Chief of Engineers. These projects include:

Construction of a reinforced concrete intake structure, approach slab, retaining walls, tunnel transitions, upstream portals, and piers and abutments for a service bridge for Garrison Dam and Reservoir on the Missouri River at Riverdale, N.Dak., under the Garrison District at Bismarck, N.Dak. ($12,000,000 to $17,000,000), July 21.

Construction of Veterans Administration 500-bed hospitals at New Orleans, La., under the New Orleans District (August 2), and at Kansas City, Mo., under the Kansas City District (August 16). Cost of each from $8,000,000 to $12,000,000.

Building of four 42,100-kva generators, with a speed of 85.7 rpm for Fort Randall Dam, South Dakota, under the Omaha, Nebr., District ($2,000,000 to $4,000,000), August 2.

Construction of 24 service gates, 4 emergency gates, 48 gate frames, 48 pairs of gate guides, and 49 pairs of dogging devices for Fort Randall Dam, under the Omaha District ($1,000,000 to $3,000,000), August 9.

N. G. NEARE'S
Column

R. Robinson Rowe, M. ASCE

"ETYMOLOGICALLY," PONDERED Professor Neare, "any problem about a goat is capricious, but this one can be very practical for any engineer owning a goat, fence and silo, who wants to take a few days off. Just double the rope and increase the pasturage 400 percent. How long was the rope, Joe?"

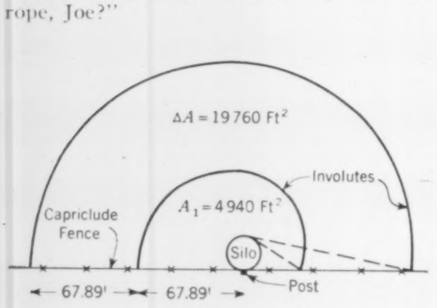

FIG. 1. DOUBLED ROPE quintuples the goat pasture.

"Let's make it a chain, Professor. I tried to work the problem by model analysis and the model goat ate the model rope. So I started with a short chain and found that doubling the chain multiplied the pasturage 8 times. Of course I should have known that, because the area between a circle of radius r, and its involute up to a generating tangent of length l is $l^3/6r$.

"Obviously, then, the chain had to reach around the silo so far that the goat was restricted by the other part of the fence. I kept lengthening my model chain. The pasturage ratio for a doubled chain diminished from 8 to 6, then to 4.5, then to 4.1, but I ran out of chain before I got it down to the specified 4. To prototype scale, I can say that the chain was more than a mile long."

"I think," said Cal Klater, "that Joe really demonstrated that the limiting area for an infinitely long chain was a semicircle proportional to the square of the chain length, so that he could never quite reach the ratio 4. I think, too, that he let you mislead him into a common mistake, for a 400 percent increase means multiplication by 5. As shown in Fig. 1, the rope was 67.89 ft long before doubling."

"Right you are, Cal, and as the computation is more tedious than difficult, I won't ask you to explain your method. It would have been more tedious if I'd asked for a 500 percent increase, for then the initial rope wouldn't have reached around the silo and the doubled rope would. However, that question wouldn't have led Joe Kerr to the impossible.

"You'll have to look at Fig. 2 for our new problem. Essentially we have a simply supported frame of 12 pinned members in the shape of a tri-star, carrying a single load so heavy that we can neglect weight of the frame. Fortunately all angles are multiples of 15° and all members have the same section, but unfortunately the architect's symmetromania has provided more members than necessary. Any one of the 12 could have been slotted at the pin, but which could be dispensed with with the least effect on stresses in the others?

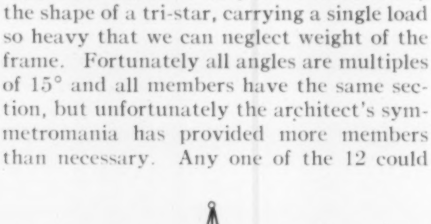

FIG. 2. OPTIMUM REDUNDANCY in trihedral cathedral root truss.

[Cal Klaters were Ed C. Holt Jr., Sto (John C.) Nagle and Anne Othernut (J. Charles Rathbun). Additional solutions t the pole-to-pole-by-daylight problem were re ceived from Marvin A. Larson and E. P. Goodrich. The new problem was derive from a suggestion by Ole Sly Drool (Leonar C. Hollister), who heard of the tri-star fram from a Mr. Zilch who wouldn't guarantee its ancestry.]

◆

Fire-Retardant Building Stressed at NFPA Meeting

CONSTRUCTION ASPECTS OF reducing fire hazards were stressed at the recent 53rd annual meeting of the National Fire Protection Association. In a featured talk presented during the four-day program, Anthony J. Mullaney, chief of the Chicago Fire Department, urged engineers and architects to be particularly cautious in the design and construction of modern windowless buildings, which present a special hazard. For all such structures, access panels and automatic fire-fighting devices are obligatory, according to the speaker. Construction materials should be fire resistant, and care should be taken in the design and construction of vertical shafts so that they do not aid in spreading fires, he said. It was also pointed out that exteriors difficult to breach, such as enameled steel or reinforced concrete slabs, constitute another fire hazard since they add to the difficulty of fire fighting.

The attendance of 950 included delegates from all over the world. ASCE was represented by James E. Jagger.

Positions Announced

City of Detroit Civil Service Commission. Open competitive examinations for Junior, Intermediate, and Senior City Planner, to be given daily from June 7 to September 6, are announced by the Detroit Civil Service Commission. Residence requirements for application have been waived. Where conditions warrant and arrangements can be made, written examination will be administered in cities other than Detroit. Current salary ranges are as follows: $3,139–3,59 $3,908–4,385, and $4,700–5,895. Slightly higher salaries are expected July 1. Application forms and information are available from the City of Detroit, Civil Service Commission, Water Board Building, 735 Randolph Street, Detroit, Mich.

New York Board of Water Supply. For work on dam and tunnel construction in Delaware and Sullivan counties. Junior Civil Engineers, $3,300 per annum; Assistant Civil Engineers, $4,020 per annum. Increments, $180 after six months; $12 after one year. Board of Water Supply, Room 1317, 120 Wall Street, New York 5

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The square tubed hand level, No. 5704, 6¼ inches long, has a simple device for right angle sighting as well.

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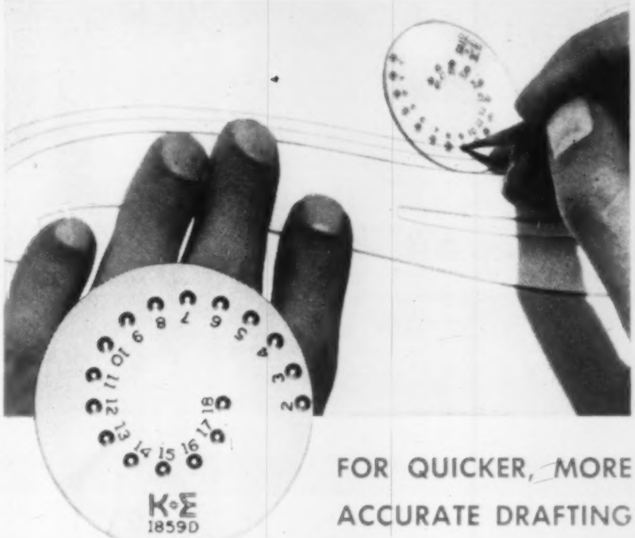

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NEW IN Education

HELPING THE RIGHT man to choose and prepare for the right job is the purpose of a new "Careers" course recently established at Stevens Institute of Technology. An innovation in engineering education, the course was originated and is sponsored by the Alumni Association of the college. Planned as an occupational survey of engineering fields and types of work, it consists of a series of 15 weekly lectures given by industrialists and others outstanding in their fields.

* * * *

DREXEL INSTITUTE WAS host recently to a two-day conference of women engineering students from 29 Eastern colleges, who met to form a regional organization of women engineering undergraduates. Established to maintain for women the professional gains made during the war, the new organization calls itself "WE." A panel discussion on the theme, "WE Can Be Accepted," was conducted by Wray H. Congdon, dean of students at Lehigh University.

* * * *

CREATION OF A new Division of Engineering Sciences in the Harvard University Faculty of Arts and Sciences "to help bridge the gap between the frontiers of pure science and engineering technology" has been announced by President James B. Conant. Prof. Gordon M. Fair, M. ASCE, present dean of the Graduate School of Engineering, will head the new division, which will unite the Faculty of Engineering with the Faculty of Arts and Sciences and permit an expanded program of education and research in applied science and engineering.

* * * *

STUDIES OF THE effect of long-term loads on full-size timber trusses are being planned by the Civil Engineering School of Georgia Institute of Technology, which invites contributions of materials and money from interested organizations. Inquiries concerning details of the research and arrangements for participation should be addressed to Melvin W. Jackson, Jun. ASCE, assistant professor of civil engineering, Georgia Institute of Technology, Atlanta, Ga.

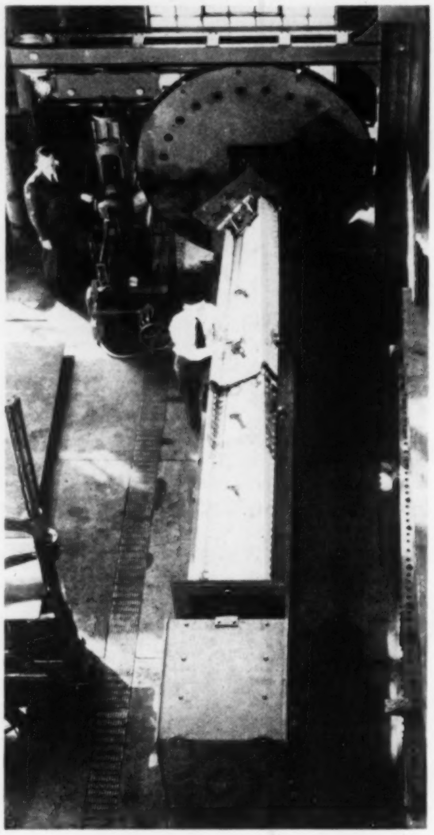
* * * *

A NEW TERMINAL degree for practicing engineers, to be called the "Engineer" degree, has been approved by the Massachusetts Institute of Technology and will be awarded for the first time at the June commencement exercises, according to an announcement from Dr. J. W. M. Bunker, dean of the M.I.T. Graduate School. The new degree will require about two years' study, following a bachelor's degree in any of the Institute's various engineering departments. Emphasis will be placed upon engineering practice rather than on the research characteristic of a program of study leading to a Ph.D. degree.

* * * *

IN *The Washington Engineer,* new quarterly publication of the University of Washington College of Engineering, wide coverage is given to technical subjects, college and alumni news, and information on campus chapters of the various engineering societies. William G. Lawrence heads the editorial staff. Subscriptions at a dollar a year may be obtained from the University of Washington Business Office, 108 Lewis Hall, Seattle, Wash. Single copies sell for 35 cents.

Lehigh U. Has Large Torsion Testing Machine



NEW 2,000,000-LB-IN. TORSION TESTING MACHINE, recently installed in Fritz Engineering Laboratory of Lehigh University Department of Civil Engineering, can accommodate specimens 4 ft 4 in. in diameter and 16 ft long. In photo Dr. Bruce G. Johnston, M. ASCE, (left) director of laboratory, applies torsion to 2-ft plate girder, as Fu-Kuei Chang, research fellow in charge, measures angle of twist with level bar. One year in construction, machine was financed largely by Lehigh University Institute of Research and Pennsylvania State Highway Department, under sponsorship of Research Corp., of New York City.

NEWS OF Engineers

Gen. Lucius D. Clay, who recently retired as military governor of Germany, was awarded the honorary degree of Doctor of Engineering from Columbia University at its recent 195th commencement exercises. General Clay, who addressed the commencement luncheon of the Alumni Federation at Columbia University, was cited as "a soldier-engineer, then a soldier-statesman who has brought unity to American policy, harmony to democratic thinking, reconstruction to a devastated land and people, and hope in a democratic way of life; always marked by unswerving devotion to duty and disregard of personal regard; an officer, a gentleman, a political scientist, a statesman of the highest order." General Clay also received honorary degrees from Bates College, and Rutgers, Yale, and Harvard universities during the current commencement season. He was made an Honorary Member of ASCE last January.

Gen. Lucius D. Clay

Louis Henke, Jr. has resigned as an engineer with the bridge planning section of the Montana State Highway Department to accept an engineering position in West Virginia. Mr. Henke recently received an honorary engineering degree at the University of Nebraska commencement exercises. He has been secretary of the Montana Section of the Society.

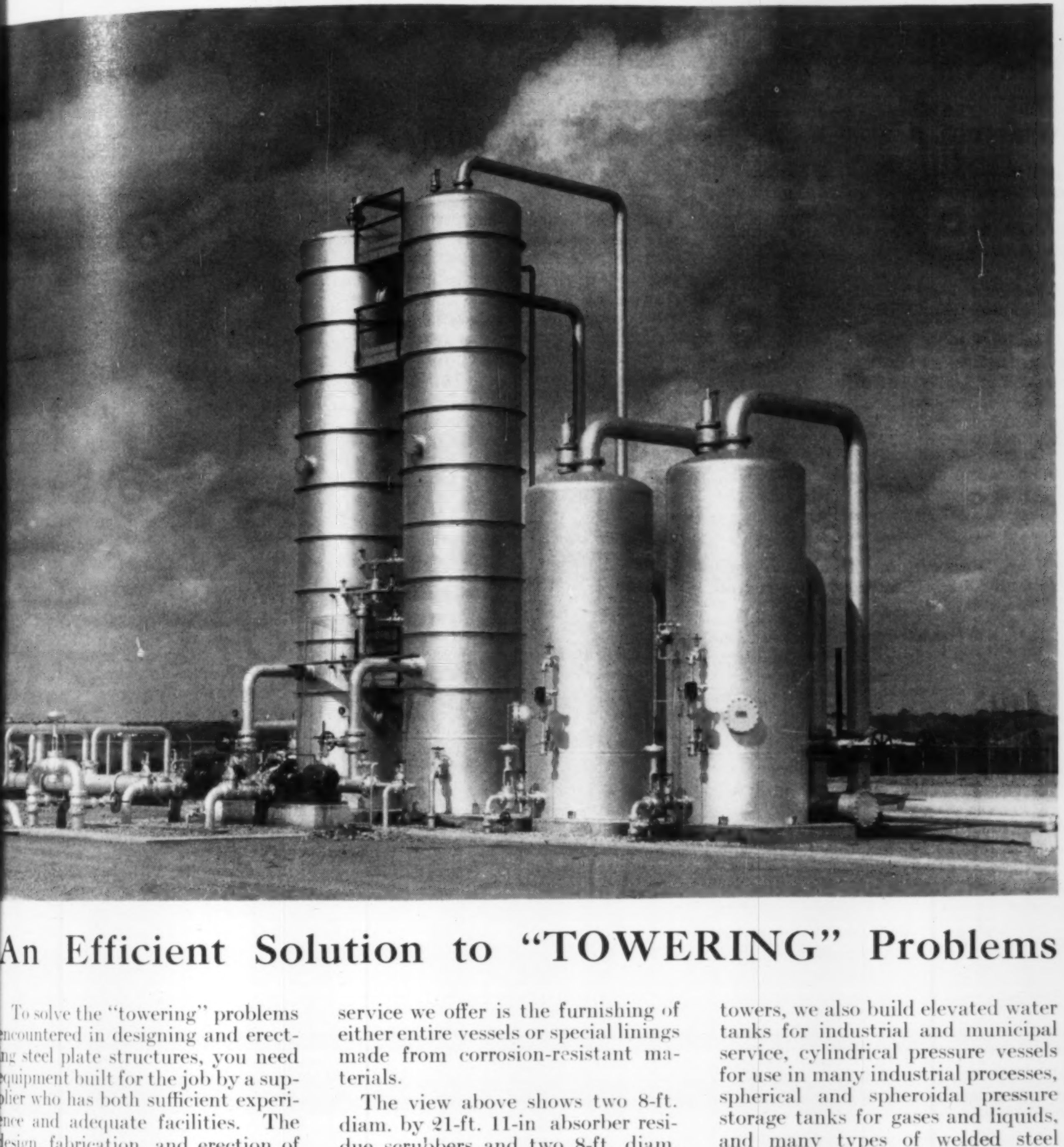
Walter J. Ryan has established a consulting office in Tacoma, Wash., under his own name, for the practice of civil engineering.

C. R. Young, dean of the University of Toronto's School of Practical Science, has retired after many years of service. Dean Young will be succeeded by Kenneth F. Tupper, until recently director of the engineering division of the atomic energy project at Chalk River.

Neal D. Smith has resigned as assistant city manager of San Diego, Calif., to accept an appointment as city manager of Santa Cruz. From 1928 to 1939 he was with the Metropolitan Water District of Southern California.

Harvey O. Schermerhorn has retired after serving the New York State Public Works Department as consulting engineer for 45 years. Mr. Schermerhorn has been engaged in highway, bridge, grade crossing, and canal construction projects for the state.

(Continued on page 72)



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To solve the "towering" problems encountered in designing and erecting steel plate structures, you need equipment built for the job by a supplier who has both sufficient experience and adequate facilities. The design, fabrication, and erection of steel plate structures has for many years been a world-wide Chicago Bridge & Iron Company service to industry.

Our plants are able to x-ray and stress-relieve vessels up to 13 feet 6 in. in diameter. With our complete facilities, we are able to furnish structures that will meet either your own or code requirements. Another service we offer is the furnishing of either entire vessels or special linings made from corrosion-resistant materials.

The view above shows two 8-ft. diam. by 21-ft. 11-in absorber residue scrubbers and two 8-ft. diam. by 42-ft. crude separators. We fabricated this equipment at our Birmingham plant for an oil company at Santa Barbara, Venezuela. These towers are typical examples of the kind of steel plate structures we can furnish to meet a wide range of pressure, vacuum and temperature conditions.

In addition to these steel plate towers, we also build elevated water tanks for industrial and municipal service, cylindrical pressure vessels for use in many industrial processes, spherical and spheroidal pressure storage tanks for gases and liquids, and many types of welded steel flat-bottom storage tanks for all kinds of liquids.

To make a wise investment in steel plate structures, you must obtain good service life at a reasonable cost of fabrication and erection. Let our engineers assist you to solve what often becomes a "towering" problem. Write our nearest office for information or quotations.

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Boston 10	1009–201 Devonshire St.	Houston 2	2128 National Standard Bldg.	San Francisco 11	1284–22 Battery St. Bldg.
Chicago 4	2199 McCormick Bldg.	Los Angeles 14	1556 General Petroleum Bldg.	Seattle 1	1309 Henry Bldg.
Cleveland 15	2263 Guildhall Bldg.	New York 6	3395–165 Broadway Bldg.	Tulsa 3	1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

(*Continued from page 70*)

C. E. Jacob, now on leave from the University of Utah where he has been head of the Geophysics Department, has opened a consulting office in Salt Lake City, Utah. His specialities are ground-water engineering and subsurface exploration, on which he spent eleven years in the service of the U.S. Geological Survey, Ground Water Branch. Mr. Jacob was this year's recipient of the Rudolph Hering Medal for a paper on "Drawdown Test to Determine Effective Radius of Artesian Well."

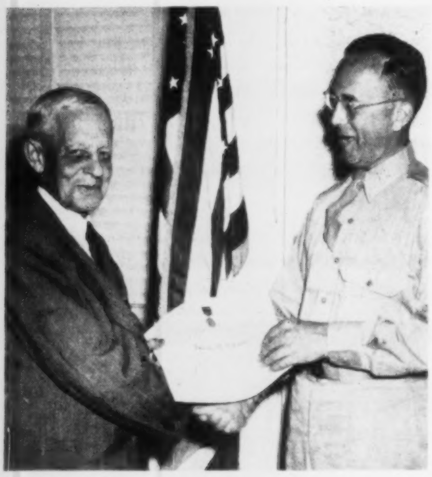
George Whittle, who has been division bridge engineer for the Public Roads Administration at San Francisco, has accepted the position of principal bridge engineer with the San Francisco Bay Toll Crossings.

Herbert D. Vogel, colonel, Army Corps of Engineers and district engineer at Buffalo, N.Y., since 1945, has been transferred to the Panama Canal, where he will serve as engineer of maintenance.

Wesley Sweat is now 5th division engineer for the Florida State Road Department at DeLand.

H. H. Roberts has accepted the position of chief engineer for Consolidated Builders, Inc., at Detroit Dam near Mill City, Ore. Mr. Roberts was previously chief engineer for Ozark Dam Constructors, Bull Shoals Dam, Mountain Home, Ark.

Two ASCE members—**J. L. Savage** and **Maj. Gen. Philip B. Fleming** are included in a *Fortune* magazine (June issue) "business roundup" of notables. Mr. Savage is cited for his "monumental hydraulic structures" and as recent winner of the Washington Award for 1949, and General Fleming for his work as administrator in numerous government agencies and his recent appointment as head of the U.S. Maritime Commission.



ROSSITER M. McCRONE (left), engineer of Mississippi River Commission receives Department of Army Award for exceptional civilian service from Brig. Gen. P. A. Feringa, president, Mississippi River Commission. Mr. McCrone developed protective asphalt blanket to be deposited on river banks to prevent erosion.

Hugh Emmet Hegarty, who has served as head of the Navy Department maintenance unit, has been named associate superintendent of public works for Takoma Park, Md. During World War II, he was on active duty with the Navy in the Pacific Theater.

Horace B. Compton, executive assistant to the chief engineer of the New York State Department of Public Works, recently resigned to take the post of principal personnel technician with the civil service department in charge of all engineering examinations. After returning from four years of service as a lieutenant commander in the Navy CEC, he was engaged by the state in 1945.

Robert L. Lewis, professor and head of the Civil Engineering Department of the Colorado A. & M. College, has been named chairman of the Department of Civil Engineering of New York University's College of Engineering, effective on September 1. For the past two years, Professor Lewis has also been chief of the civil engineering section at the Colorado Agricultural Experiment Station.

Randolph P. Hoelscher, director of engineering courses and professor of general engineering drawing, at the Navy Pier Branch of the University of Illinois, has been appointed head of the general engineering department, succeeding Prof. H. H. Jordon, who is now associate dean.

Robert S. Johnson, for the past 19 years district bridge engineer in the Public Roads Administration office at Albany, N.Y., has been named district engineer for the PRA in the Philippines, where he will direct rehabilitation of roads and bridges.

L. F. Harza, Chicago consultant, recently returned from a round-the-world air trip in company with an engineering assistant **C. K. Willey.** They advised on hydroelectric power problems in the Philippines for the National Power Corp. Mr. Willey remains in the Philippines for several months to supervise the work.

B. P. Thomas, principal engineer for the Seattle, Wash., District of the Corps of Engineers, has been placed in charge of the Design Section of that office.

Horton Whipple and **S. K. Whipple** have opened a civil engineering office in Palo Alto, Calif., under the name of Whipple Engineering Co. The new concern succeeds that of Thomas & Whipple, also of Palo Alto.

Paul H. Underwood will retire this summer after 29 years as head of surveying construction in the School of Civil Engineering at Cornell University. During his long tenure, he has supervised more than 6,000 surveying parties.

Thomas F. Thompson, formerly chief of the Geology Section of the Panama Canal, has become chief of the Geology and Explorations Section of the Corps of Engineers District office at Walla Walla, Wash.

James D. Piper, previously district highway engineer for the Portland Cement Association at Dallas, Tex., has been named district engineer in charge of all of the organization's work in Texas, with headquarters at Austin. The Austin office was recently consolidated with the Dallas headquarters into a single district office. **Charles A. Clark,** who has been in charge of the association's activities in other than highway paving and bridge fields for over 27 years, will continue as office engineer at Austin.

John J. Theobald, dean of administration and professor of civil engineering at the College of the City of New York, has been elected to the presidency of Queens College by the New York City Board of Higher Education. Dean Theobald assumed his new duties as head of Queens College on July 1. He has been on the staff of City College since 1929.

Dean J. J. Theobald

James P. Growdon, chief hydraulic engineer for the Aluminum Company of America, was recently awarded the honorary degree of Doctor of Engineering by the University of Nebraska, his alma mater, at the school's commencement exercises in Lincoln. Mr. Growdon has won wide recognition as an authority on hydraulic developments. In the recent war, he served as a colonel in the European Theater and in 1946 was appointed by the Chinese government as a member of a three-man consulting board formed to study the flooding problems of the Yellow River.

Asrar A. Qureshy, after completing two years of study at the State University of Iowa, has returned to Lahore, Pakistan, where he will take the post of design engineer in the Irrigation Branch of the West Punjab Provinces government. Mr. Qureshy will be responsible for the construction and maintenance of irrigation and hydroelectric works in that province.

Thomas O. Breitling, formerly associated with the Tela Railroad Co., in the Republic of Honduras, is now assistant to the construction engineer of the Mississippi State Highway Department at Jackson, Miss.

F. H. Kellogg, chairman of the Department of Civil Engineering at the University of Mississippi, School of Engineering, was recently appointed consulting engineer to the government of Bombay Province, India. In this capacity, Dr. Kellogg will direct and review construction operations on the power and irrigation development known as the Gangapur Project in Bombay Province.

William B. Upton, Jr. has been made district engineer of the U.S. Geological Survey in the Rocky Mountain Region. He previously served in Washington, D.C.

(*Continued on page 74*)

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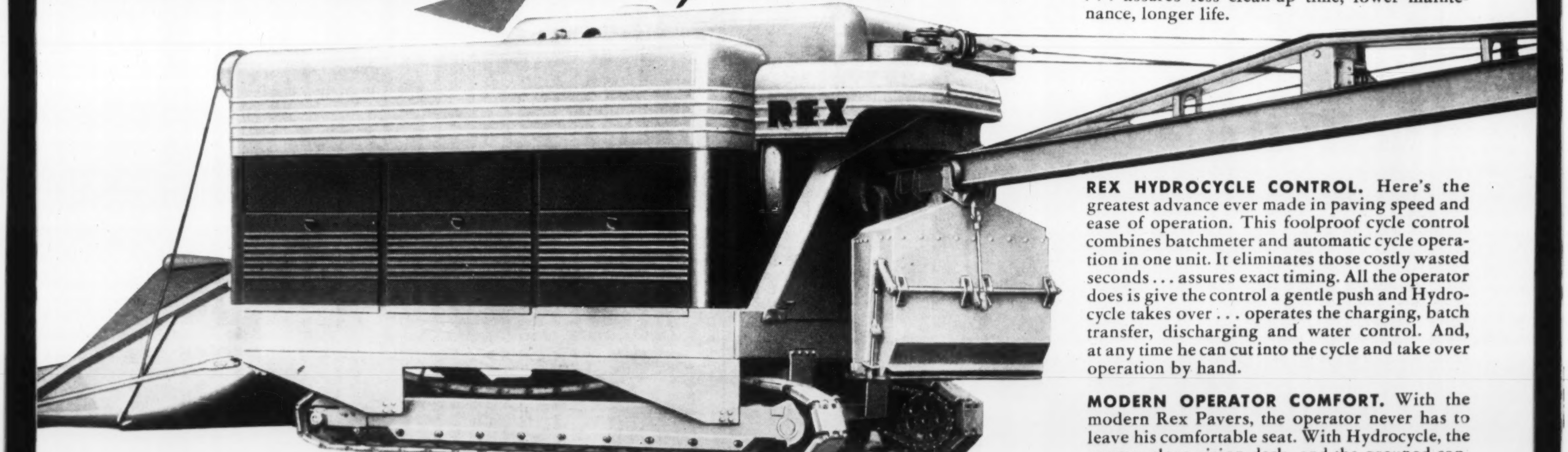
REX ACCESSIBILITY. The modern streamlined shielding makes these the most accessible pavers you've ever seen. Big, easy-opening doors permit quick access for lubrication and inspection. And streamlining keeps dirt off the working parts . . . assures less clean-up time, lower maintenance, longer life.



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(*Continued from page 72*)

Elmer K. Timby has resigned as chairman of Princeton University's Civil Engineering Department, after serving on the university staff since 1928, to join the New York and Kansas City firm of Howard, Needles, Tammen & Bergendoff. Professor Timby is a member of the Executive Committee of the ASCE Construction Division.

John M. Henderson, professor of sanitary science in the Columbia University School of Public Health, will act as a consultant in malaria control for the World Health Organization of the United Nations, with headquarters at New Delhi, India, training center in malaria control for southeastern Asia. Professor Henderson will resume teaching at the start of the fall semester.

S. A. Weakley has retired from the U.S. Engineer Department's office at Nashville, Tenn., where since 1939 he has held the post of chief of the Operations Division in charge of operations and maintenance of the Cumberland River locks, dams, and navigation channel, and the Tennessee River locks. During his 38 years of duty with the Corps of Engineers, Mr. Weakley served in various capacities.

Joseph A. Killian recently retired from the Standard Oil Co. of Sacramento, Calif., and is now living in Santa Barbara.

John M. Buckley, secretary of the ASCE Waterways Division, member of the annual meeting committee, and program chairman of the Metropolitan Section, was recently sworn in by Mayor O'Dwyer as consulting engineer in the Department of Marine and Aviation, City of New York.

Harold B. Gotaas is the new chairman of the Civil Engineering Division of the University of California, Berkeley, succeeding **Prof. Bruce Jameyson,** who has resigned. For several years Professor Gotaas has been on the civil engineering staff there.

D. K. Caldwell, who is president of the Caldwell Oil Corp., of Tyler, Tex., recently was honored by the Dallas Historical Society at its 27th anniversary meeting.

COL. DAVID W. GRIFFITHS, M. ASCE (left), district engineer, Grecian District, Corps of Engineers, displays decoration as Knight of Order of Phoenix for distinguished services to Greece recently awarded him by King Paul. He is pictured here with Maj. B. C. Koch. Another member of his staff, Lt. Col. Paul D. Troxler, M. ASCE, was honored with Gold Cross of Order of George I.

Carl Henry Cotter has been elected president of the Merritt-Chapman & Scott Corp., of New York City.

Benjamin F. Fairless, president of U.S. Steel Corp. and vice-president of the American Iron and Steel Institute, is the recipient of the Gary Memorial Medal—established by AISI in 1927 to commemorate the achievements of Ebbert H. Gary, its founder and first president. Mr. Fairless was cited for his "outstanding achievements in handling problems of steel supply for war and for peace, and in fostering a better understanding of this industry."

M. L. Enger, who recently retired as dean of engineering at the University of Illinois after 42 years of service, was paid homage by approximately 500 colleagues, alumni, students, and other friends, at ceremonies unveiling his portrait, which was painted by Prof. Charles E. Bradbury of the Department of Fine and Applied Arts. The portrait will be hung in the University's engineering library.

The Institute of Transportation and Traffic Engineering at the University of California has added two ASCE members to its Berkeley staff. They are **Forest H. Green,** who will be visiting associate professor of transportation engineering and associate engineer in the Institute, and **Dimitri P. Krynine,** visiting professor of civil engineering, whose special field is soil mechanics.

R. Earl Salveter, executive vice-president of the Woermann Construction Co., St. Louis, Mo., was installed as president of the St. Louis Engineers' Club for the year 1949-1950 at its 81st annual meeting.

Deceased

William Thomas Barnes (M. '11) engineer of Wilkes-Barre, Pa., died on May 13, at the age of 78. A graduate of Massachusetts Institute of Technology, Mr. Barnes early in his career became connected with the Boston firm of Leonard Metcalf (now Metcalf & Eddy) on the design and construction of water works and sewerage systems in many parts of the country. For almost 30 years he had been chief engineer and director of the Scranton-Spring Brook Water Service Co., at Wilkes-Barre.

Henry Emmett Bartlett (M. '11) engineer of Chicago, Ill., died on February 7, according to word just received at Society Headquarters. He was 78 and an alumnus of the University of Illinois. A specialist in the valuation of public utilities, Mr. Bartlett was assistant chief engineer for the Illinois Public Utilities Commission from 1915 to 1931, and from 1933 until recently was consulting engineer for the commission, in charge of the appraisal of property for many large utilities in the Chicago area. He had also been chief engineer for James Walker, Chicago consultant, specializing in public utility appraisals, and earlier in his career was engaged in railroad engineering.

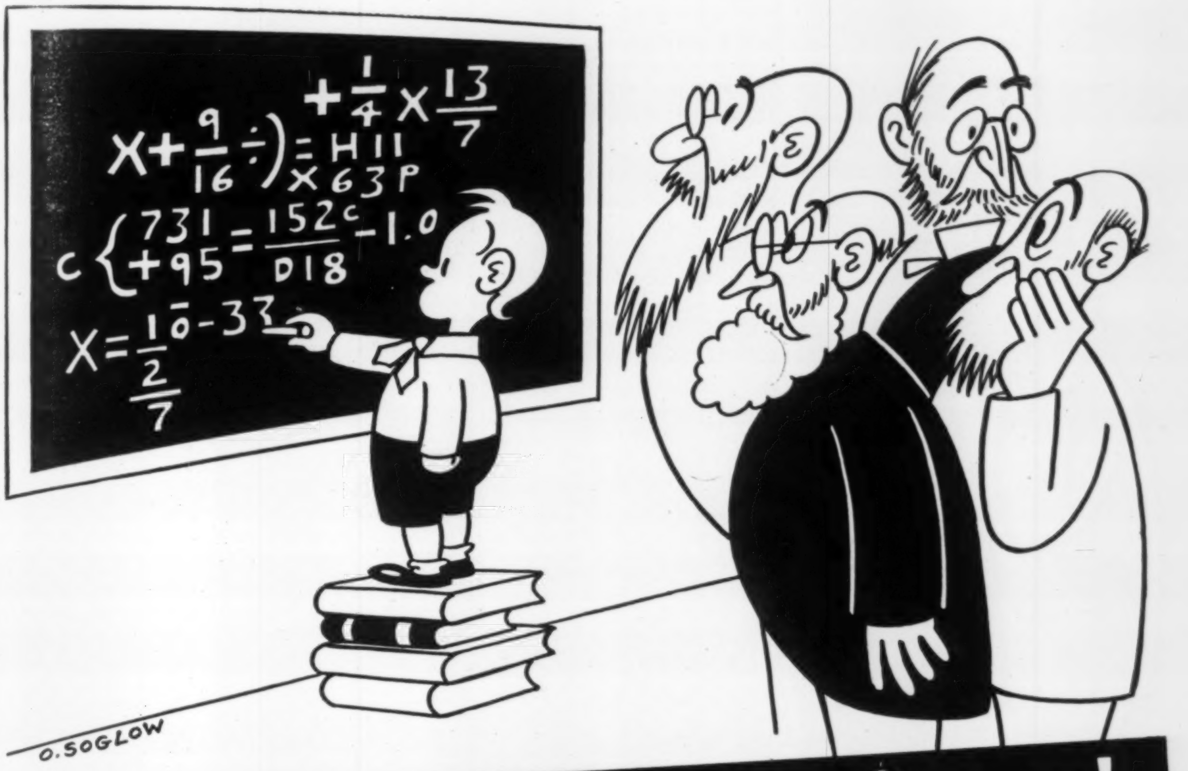
Oscar Francis Bellows (M. '06) retired civil engineer of Danielson, Conn., died in Brooklyn, Conn., on May 20, at the age of 74. Mr. Bellows had been with the New York State Engineering Department in a number of capacities, and as assistant engineer for the New York and New Jersey Bridge & Tunnel Commission from 1920 to 1927 he was engaged on the design of the Holland Tunnel between New York and New Jersey. Mr. Bellows then became connected with the New York City Board of Water Supply, where he remained until his retirement in 1937. He was a graduate of Brown University.

Jay Downer (M. '28) chief engineer of the New York International Airport at Idlewild, Queens, and a leader in the development of Westchester County's parkway network, died in a New Rochelle, N.Y., hospital on May 30 at the age of 72. His home was at Larchmont, N.Y. Following his graduation from Princeton University in 1905, Mr. Downer was employed on railroad work and later as resident engineer for the Aluminum Company of America at its Massena, N.Y., plant. As chief engineer of the Bronx Parkway Commission from 1911 to 1925 and of the Westchester County Park Commission from 1923 to 1934, Mr. Downer was in charge of a $104,000,000 program of parkway construction and improvement. In addition, he supervised construction of the county beach and amusement park at Rye, N.Y., called Playland, and the Westchester County Center at White Plains, N.Y., that has served as a model for many similar projects. Entering private work in 1935, Mr. Downer was named a director of Rockefeller Center, Inc., and served on the board of design for the New York World's Fair. His last great project was the $200,000,000 Idlewild Airport, for which he formed the firm of Downer, Green & Carrillo. Since his retirement because of ill health about a year ago, the successor firm, Carrillo & Green is completing the contract.

Jay Downer

George Paxson Jones (Assoc. M. '18) retired engineer of Roanoke, Va., died at his home there on March 10, at the age of 7 Mr. Jones spent much of his career with the Virginia Bridge Co. at Roanoke—first as estimator and designer, and from 1922 until his retirement in 1942 as assistant engineer

(*Continued on page 77*)



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- 7,500,000 workers are buying an individual average of $20 of Bonds per month.
- For the year 1948, sales of Series E Bonds *exceeded redemptions* by $495,148,000. The net figure for all Series after redemptions and maturities was $2,151,140,000.

What does all this mean to you? Well, it means first of all that your Treasury Department is successful in its program of increasing the nation's economic security by spreading the national debt. Secondly it means that most of the nation's business leaders recognize the value of the Payroll Savings Plan sufficiently to promote it within their companies.

For example...

To give you some idea of the Plan's growing popularity: 86,384 employees of a prominent electrical manufacturing company were investing in Bonds at the rate of $30,005,270 as of the end of 1948. This is a gain of nearly 100% over 1947, when 45,000 employees participated in that company. The treasurer of a well-known shoe company reported that, of his concern's 19,060 employees, 9,240 were in the Plan and had invested $146,807.32 in Bonds via deductions during the preceding month.

Why promote it?

We all know how buying Bonds builds an individual's future security. But there are *company* benefits too! Nation-wide experience shows that Payroll Savings increases each participating employee's peace of mind—makes him a more contented, more productive worker. It reduces absenteeism, lowers accident rates, increases output, and improves employee-employer relations.

It's easy to boost participation

1. See that a top management man sponsors the Plan.

2. Secure the help of the employee organizations in promoting it.

3. Adequately use posters and leaflets and run stories and editorials in company publications to inform employees of the Plan's benefits to them.

4. Make a person-to-person canvass, once a year, to sign up participants.

These first four steps should win you 40-60% participation. Normal employee turnover necessitates one more step:

5. Urge each new employee, at the time he is hired, to sign up.

Nation-wide experience indicates that 50% of your employees can be persuaded to join—without high-pressure selling. All the help you need is available from your State Director, U. S. Treasury Department, Savings Bond Division.

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This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

New Publications

Asphalt. With issuance of the April 1949 number of the *Asphalt Institute Quarterly*, the Asphalt Institute launches a new publication, designed to disseminate information on the economic and technical advantages of asphalt. Correspondence and inquiries are invited by the Asphalt Institute, 801 Second Avenue, New York 17, N.Y. Subscriptions are free.

Radioactive Materials. An extensive bibliography on the industrial uses of radioactive tracers has been made available by Arthur D. Little, Inc. (Cambridge 42, Mass.), from whom copies may be obtained without charge. Radioactive isotopes have two principal industrial uses—as atomic tracers or detectors and as compact portable sources of radiation.

Welding. Information on new welding processes developed in the past eight years is given in a second edition of *Welding Metallurgy*, which has been revised by G. E. Linnert and issued by the American Welding Society. The fundamentals of metallurgy are outlined in the first chapters for those having no previous knowledge of the subject, and the welding metallurgy of specific materials and the effect of different elements are discussed in later chapters. Copies sell for $2.50, upon application to the American Welding Society, 33 West 39th Street, New York 18, N.Y.

Welding Terms. To formulate a suitable, standard terminology for welding, the American Welding Society has just published a 50-page bulletin on *Standard Welding Terms and Their Definitions*. This standard, which was four years in preparation, includes more than 500 terms and 57 illustrations. Copies may be purchased from the American Welding Society, 33 West 39th Street, New York 18, N.Y., at $1 each. Also available from the AWS is a new standard *Master Chart of Welding Processes*, which lists all 37 welding processes in commercial use today, and *Process Charts*, comparing these processes in point of similarity and difference with 24 fundamental characteristics of production welding. Together the charts sell for 35 cents.

Surveying Instruments. The 51st edition of the *Manual of Surveying Instruments*, recently published by W. & L. E. Gurley, Troy, N.Y., combines specific details of the adjustment of Gurley instruments with related factual information and practical instruction data on the care and handling of all transits, levels, alidades, compasses, and accessory surveying equipment. Copies of the 166-page illustrated booklet are available to engineers at $1 a copy, upon application to W. & L. E. Gurley, Troy, N.Y.

Water Supply, Ohio. The water outlook for 1949 in each of Ohio's 88 counties is summarized in Bulletin No. 20 of the Ohio Water Resources Board. The availability of water in streams has been described for each county by means of an index of flow, and streams are classified as to flow characteristics. Quantities of water pumped for industrial use are listed for each county. Industrial pumpage of ground water is indicated on a map, which also shows counties where additional supplies of 3 mgd or more are available for development. Inquiries concerning the bulletin should be addressed to the Ohio Water Resources Board, Columbus, Ohio.

Vocational Guidance. Young men thinking about jobs and careers will be interested in an *Occupational Outlook Handbook*, prepared especially for veterans by the Bureau of Labor Statistics in cooperation with the Assistant Administrator for Vocational Rehabilitation and Education of the Veterans' Administration. The 453-page book covers 288 professional, semi-professional, administrative, clerical, service, trades, and agricultural occupations. Chances of getting a job, how to go about it, qualifications and training needed, experience, pay, and the prospects for future advancement are discussed for each of the 288 occupations. This reference may be purchased from the Superintendent of Documents, Washington 25, D.C., at $1.75 each.

Technical Societies. Data for 1,302 engineering and scientific organizations in the United States and for 166 in Canada are included in a recent revision of the *Handbook of Scientific and Technical Societies and Institutions*, sponsored jointly by the National Research Council and the Canadian Research Council. Copies of the 371-page volume, priced at $5, may be obtained from the National Research Council, National Academy of Sciences, Washington 25, D.C.

(Continued on page 83)

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(Continued from page 74)

Ralph Emerson Borrowman (Assoc. M. '28) city engineer of St. Cloud, Minn., died on March 25, at the age of 59. Since 1928 Mr. Borrowman had been in the employ of the City of St. Cloud, which he served as engineer, superintendent of water works, and building inspector. Before that he was sales and designing engineer for the Lewistown Concrete Pipe Co., at Fort Wayne, Ind.

Wright Semion Cockroft (M. '47) superintendent of construction for the St. Paul, Minn., Department of Public Works, died in that city on May 26. Mr. Cockroft had been a member of the city engineering division for almost 25 years, except for a few years as engineer for the Public Works Administration. He was named assistant city engineer in charge of construction in 1938. Mr. Cockroft was a graduate of the Michigan State College School of Engineering, a past-president of the Engineers' Society of St. Paul, and president-elect of the Minnesota Association of Professional Engineers. A veteran of World War I, he was active in American Legion work.

Charles Rutherford Goddard (Assoc. M. '46) purchasing agent for the White Construction Co., of New York City, died at his home in Rahway, N.J., on May 21. He was 59. From 1929 to 1931 and from 1946 until his death, Mr. Goddard was connected with the White Construction Co., as project manager and purchasing agent. From 1934 to 1937 he was engaged on a special emergency construction program for the U.S. Treasury Department, and from 1938 to 1941 he was associate civil engineer in charge of the Construction Section of the WPA in New York City. As chief of the Operations Division of the U.S. Engineer Office at St. Louis from 1942 to 1946, Mr. Goddard supervised a huge program of war construction for the Corps of Engineers. In World War I, he served overseas in the Construction Division of the Air Service.

John Klorer (M. '30) retired engineer of New Orleans, La., died there on April 24, at the age of 74. A native of New Orleans and graduate of Tulane University, Mr. Klorer was city engineer of New Orleans in the early twenties, and from 1925 to 1930 was public property commissioner. In these capacities, he was responsible for rebuilding the city's public markets and for a $2,500,000 program of paving improvements. As chief engineer of the New Orleans Levee Board, he was active in Mississippi River flood control work, and he had been chief of the board of state engineers and planning engineer for the sewerage and water board. In 1941 he was appointed supervising engineer of the engineering division of the Reconstruction Finance Corporation in Washington, and during the war served as an engineering consultant for the Navy. He retired in 1946. Mr. Klorer was a past-president of the American Society for Municipal Improvements.

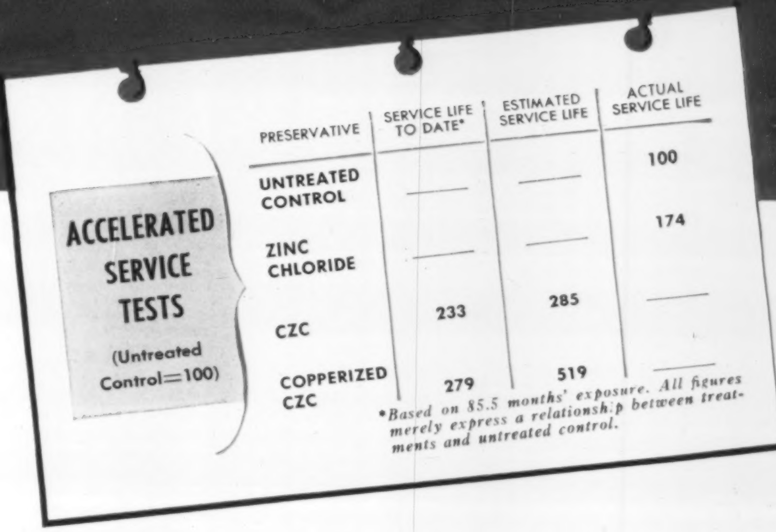
John Birger Lindhe (Assoc. M. '08) former U.S. shipping commissioner, New Orleans,

(Continued on page 79)

Announcing–

COPPERIZED CZC-TREATED WOOD

for even longer life!



ACCELERATED SERVICE TESTS (Untreated Control=100)

PRESERVATIVE	SERVICE LIFE TO DATE*	ESTIMATED SERVICE LIFE	ACTUAL SERVICE LIFE
UNTREATED CONTROL	—	—	100
ZINC CHLORIDE	—	—	174
CZC	233	285	—
COPPERIZED CZC	279	519	—

*Based on 85.5 months' exposure. All figures merely express a relationship between treatments and untreated control.

THANKS to an improved preservative formulation, Copperized Chromated Zinc Chloride, you can count on greater service life from salt-treated wood.

This new formulation . . . the product of cooperative research by chemists of E. I. du Pont de Nemours & Co., Inc., and Koppers Company, Inc. . . . provides longer service life than Chromated Zinc Chloride, the salt preservative from which it was developed. Accelerated service tests bear this out, as shown in the accompanying table.

While adding extra years of service, this new preservative retains all the outstanding advantages of CZC. It is decay resistant, termite repellent, clean, odorless and paintable. There is no loss of strength in wood treated with Copperized CZC.

You'll add years of service to framing, roof decking, sheathing, trusses, siding, platforms and other installations by using wood pressure-treated with this new COPPERIZED CZC. It's a worthwhile investment . . . investigate it today.

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

Engineering Societies PERSONNEL SERVICE, INC.

NEW YORK
8 W. 40th ST.
•
CHICAGO
84 E. RANDOLPH ST.
•
DETROIT
100 FARNSWORTH AVE.
•
SAN FRANCISCO
57 POST ST.

Men Available

Sanitary Engineer; Jun. ASCE; 33; married; B.S., M.C.E.; 11 years' varied experience. Desires permanent position in public health, water supply, or sewage treatment. Prefers Eastern location but will consider others. C-497.

Structural Engineer; Jun. ASCE; S.M., M.I.T.; 3 years' experience in railway work and general design and construction. Positions leading to administrative openings or in design desired. Will locate anywhere except Southern states. C-498.

Civil Engineer; M. ASCE; registered; 61; married; graduate; 35 years' experience, private construction and government service, buildings, warehouses, piers, lighthouses, air-strips, dwellings, administration, management (technical), cost analyses, design, estimates, specifications, contracts, safety, and supervision. Available immediately. C-499-495-A-9.

Field Engineer; Jun. ASCE; 32; single; both business and C.E. degrees. Party chief on two foreign pipelines. Survey and office experience on railroad, airport and cantonment construction, and pipelines. Available immediately. C-500-495-A-8.

Civil Engineer; Jun. ASCE; M.S.; 32; married; 4 years' experience in different civil engineering works. Recent 4 months' experience in design of reservoirs. Seeks connection with company engaged in design and construction of reservoirs, filtration plants, water supply systems. Prefers foreign location of long duration. C-501.

Structural Engineer; Assoc. M. ASCE; 30; married; college graduate with advanced degrees; 5 years' experience in structural design with consulting engineer's firm. Desires teaching courses in field of structural engineering. C-502.

Civil Engineer; June graduate, Brooklyn Polytechnic Institute; 24; married; 3 years in U.S. Army, surveying, operations, and 1st sergeant. Worked summers as surveyor for a builder; can meet and get along with men in all positions. Desires permanent position with future with contractor or construction company. C-503.

Civil Engineer; 26; single; veteran. Graduate, Washington University, construction option. Limited survey and hydraulic design experience. Willing to start at bottom with reputable contracting organization. Anything from laborer to leg-man for field superintendent. Prefers Metropolitan New York, but will locate anywhere. C-504.

Civil Engineer; Jun. ASCE; 28; married no children. B.C.E., Cornell University. Railroad Division Engineer Office, track planning and layout; oil refinery construction, equipment layout, and pipe sketching. Postgraduate work indeterminate structures. Desires position with engineering concern with opportunity for field and office work. Available 2 weeks' notice. Will locate anywhere. C-505.

Civil Engineer; Jun. ASCE; graduate Notre Dame University, 1947; a year's graduate study in civil engineering; 24; single. Desires teaching position in Statics, Strength of Materials, Materials Laboratory Courses or College Algebra and Trigonometry. Wishes to continue graduate study in Soil Mechanics if possible. Prefers Michigan or Midwest. C-506.

Civil Engineer; Assoc. M. ASCE; B.S. and M.S. degrees; registered engineer. Two years' field experience in Construction; 3 years' college teaching in Civil Engineering and Mechanics; and 4 years' as officer in U. S. Army. Available August 1. C-507.

Civil Engineer; Jun. ASCE; recent graduate, June 1948; 24; married. B.S. North Carolina State College; a year's experience with general contractor. Desires employment with municipality, consultant, or as an Instructor. Prefers South or East. C-508.

Positions Available

Construction Engineer, mechanical or civil graduate, 28–35, with petroleum terminal experience, to supervise waterfront construction, tank erection, draw-up contracts, sublet work, etc. Married men preferred with knowledge of Portuguese. Salary, $7,000–$8,000 a year. Location, Brazil. Y-2419.

Instructors in civil engineering, to teach elementary surveying, advanced surveying, highways, and allied subjects. Positions start September 1949. Location, East. Y-2430.

Irrigation Engineer with at least 10 years' experience in planning, designing, and estimating distribution systems and drainage works, and with basic knowledge of agronomy. U.S. engineering firm with initial assignment in Near East. Y-2425.

Senior Structural Engineer, graduate, with experience on waterfront structures, foundations, and building structures. Will do structural designing, analyze and consult on various types of structures, such as waterfront bulkhead, quay walls, wharfs, foundations and buildings of all types, and related matters involving structural problems. Salary, $7,500–$8,400 a year. One-year contract. No housing can be furnished Location, Guam. Y-2435S(*a*).

Instructors or Assistant Professors. (a) Civil Engineers, graduates, with master's degrees, one to teach strength of materials, testing material, and mechanics, some opportunity for development in testing laboratory; and the other to teach sanitary engineering together with mechanics and surveying. Location, New England. Y-2460.

Planning and Engineering Assistant, 26–52, graduate with degree in civil engineering and one year of advanced training in public administration, planning administration, land economics, or related fields; and not less than 6 months' experience, which has provided a practical knowledge of public works engineering techniques or familiarity with municipal planning and zoning problems. Three years' experience in the field of economic or physical planning in state or local government may be substituted for foregoing requirements. Will perform technical civil engineering work in connection with the construction of roads, storm drains, and sidewalks, including setting of grades and preparation of plans, profiles, and specifications, etc. Starting salary, $3,180 with increase in 6 months to $3,270–$4,120 a year. Location, Connecticut. Y-2469.

Civil Engineer, 40–45, with 10 years' experience in hydraulics and hydroelectric structures, particularly in reinforced concrete and earth dams. One year to 18 months' work in Buenos Aires, S.A. Housing facilities and transportation provided. Salary, $10,000 a year. Y-2474.

Designer, 30–35, to design hot and cold lime process water conditioning plants. Should understand the chemistry of water and should have had some experience in both the design and operation of such plants. Location, Iowa. Y-2476-C.

Chief Port Engineer, over 45, civil graduate, with 10 to 15 years' experience in port and harbor construction, particularly on the engineering side. Four-year contract. Salary, $15,000 a year. Tax exempt. Living accommodations provided. Location, Turkey. Y-2490.

City Engineer, 35–45, preferably married, to take charge of all the responsibilities of that office, as well as outline the work for the street and sewer work groups. Starting salary, $5,000 a year. Location, Illinois. Y-2491-R-5697.

Assistant Professor, civil, with master's degree and practical experience in structural design as well as some teaching experience, to teach theory of structures, soil mechanics, foundations, and eventually, indeterminate structures. Salary open. Location, Rhode Island. Y-2512.

Office Evaluation Engineer, civil graduate, with several years' experience in the analysis of costs, price settings, etc., on water works, water treatment plants, and piping, etc. Salary, $6,000–$7,200 a year. Location, New York, N.Y. Y-2527.

Project Engineer, graduate civil engineer, 30–55; 5 or more years' experience on natural gas, compressor stations, and plants. Primarily office engineering job with occasional field trips. Salary, $5,400–$6,600 a year. Location, Missouri. R-5701(*a*).

Sales Engineer; 35–45; extensive experience in sale and distribution of highway construction materials to municipal, state, county, and federal agencies through distributors. Will promote the use of neoprene concrete joint seal. Travel about 50 percent over U.S. Headquarters, Chicago. Salary, $5,000–$7,500 a year. R-5706.

REGISTERED CIVIL ENGINEER WANTED

The Borough of Hollidaysburg, Pennsylvania, has a vacancy for a full time Registered Civil Engineer. Qualifications—To make surveys of Streets, Water and Sewer Lines and to have charge of all construction work within the Borough. Applications are to be sent to the Borough Secretary's Office, 401 Blair Street, Hollidaysburg, Pennsylvania.

(Continued from page 77)

La., died in that city on April 14. He was 72. A graduate of Tulane University, Mr. Lindhe spent his early career with the government on flood control work on the Mississippi and on maintenance work on the Panama Canal. Later he was with the Lykes Brothers Steamship Co., and from 1931 until his retirement in 1943 he was U.S. shipping commissioner in New Orleans. In World War I, Mr. Lindhe served as a lieutenant commander in the Navy.

Willard Pope (M. '04) retired bridge engineer and Detroit civic leader, died in a hospital in that city on June 2. His age was 82. An organizer of the Canadian Bridge Co. at Walkerville, Canada, Mr. Pope served as vice-president and chief engineer until his retirement in 1921. He was principal builder of the famous cantilever bridge across the St. Lawrence River at Quebec, and for some years served on the Detroit Rapid Transit Commission. A graduate of the University of Michigan, Mr. Pope was a charter member of the University Club in Detroit and of the Thursday Club, a civic group instrumental in the creation of the Detroit Community Fund.

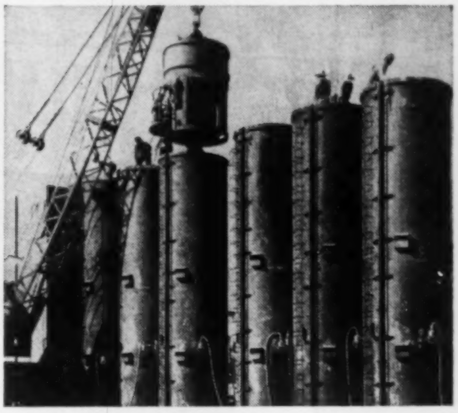
Philip Sawyer (M. '21) senior partner in the New York architectural firm of York & Sawyer, died on May 21, at the age of 81. Educated as a civil engineer, Mr. Sawyer was with the U.S. Geological Survey on irrigation work in the West in his early career. Later he studied architecture at Columbia University and at the Ecole des Braux Arts in Paris, and in 1898 founded the firm of York & Sawyer. He was consulting architect to the Treasury Department from 1909 to 1913 and to the New York Board of Water Supply from 1907 to 1919. Notable structures designed by his firm include many New York buildings, the Department of Commerce Building in Washington, the Naval Hospital at St. Albans, Queens, and the law buildings at the University of Michigan. Mr. Sawyer was a member of the Beaux Arts Society and the American Institute of Architects.

Herbert Schmitt (Assoc. M. '48) assistant superintendent of filtration, Milwaukee Water Works, Milwaukee, Wis., died recently. Mr. Schmitt, who was 58, had been connected with the city engineering department since 1919. He began his duties with the water department in 1928, and had been engineering draftsman, pitometer engineer, and field engineer on construction of the city's new purification plant. In 1938 he was appointed assistant superintendent. Mr. Schmitt was prominent in Masonic activities and in the American Legion.

John Cresson **Trautwine, 3d** (M. '20) engineer editor and publisher, of Ithaca, N.Y., died recently. Mr. Trautwine, who was 71, had spent a number of years as editor and publisher of the Trautwine Co., which issued several editions of a reference work for civil engineers prepared by Mr. Trautwine. Before going to Ithaca, Mr. Trautwine conducted his business at Wallingford, Pa., and still earlier in his career he was in charge of water-supply investigations for J. H. Weaver & Co., of Philadelphia. Mr. Trautwine was a graduate of Cornell University.

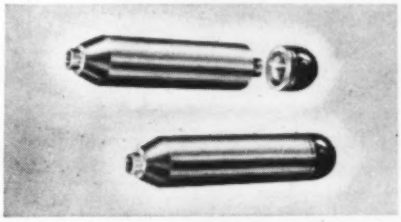
VIBER SAVES TIME AND COST IN CONCRETE CONSTRUCTION

TESTS of NEW DESIGNS and DEVELOPMENT in VIBER EQUIPMENT PROVE INCREASED EFFICIENCY at LOWER MAINTENANCE COSTS



PX-6 EXTERNAL VIBRATOR EXTREMELY EFFECTIVE IN MANUFACTURE OF CONCRETE PRODUCTS and HANDLING OF DRY MATERIALS

The proper balance of amplitude and speed over a wide range produces marked improvement in the manufacture of concrete pipe and greatly increases the life of the forms. Many placement problems have been solved by this new vibrator.

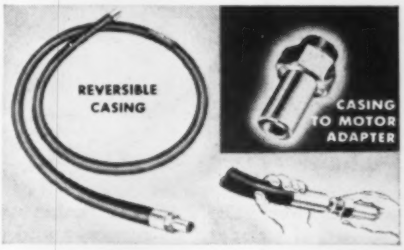


VIBER RUBBER-TIPPED VIBRATORS REDUCE FORM DAMAGE

Damage to expensive form lining materials necessitating frequent form replacement was the reason for development of Rubber Tipped Vibrators. Severe tests on many large concrete jobs proved costly grinding due to damaged forms was greatly reduced. Another advantage of Viber's Rubber Tipped Vibrators is replaceable tip. Simply unscrew worn part and install new tip.

REVERSIBLE FEATURE PRACTICALLY DOUBLES THE LIFE OF CASINGS

Standard 6, 12 and 21 foot interchangeable Viber casings are reversible. Reversing is easily accomplished by unscrewing adapter and attaching it to the other end. All cores are reversible. Viber casings are covered with durable, live, tire quality rubber.



For further information or descriptive literature on Viber equipment, please write Dept. 18.

VIBER COMPANY • **Concrete Vibrators Since 1931**
726 South Flower Street
Burbank, California

Bureau of Reclamation Announces New Projects

Among new Western construction projects, announced by the Bureau of Reclamation in its *Advance Construction Bulletin* for June 1, under head of "Bid Calls Expected This Month," are the following:

CONCRETE PIPE LATERALS
All-American Canal, California

Location: Near Thermal, Calif.

Work: Construction of about 70 miles of concrete pipelines and structures for laterals, sublaterals, and wasteways of lateral unit No. 7 of the Coachella Valley distribution system.

Excavation	376,000 cu yd
Concrete	1,450 cu yd
Furnishing and placing reinforcing steel	162,000 lb
Furnishing and laying 10- to 20-in. diameter unreinforced concrete pipe	222,000 ft
Furnishing and laying 21- to 78-in. diameter reinforced concrete pipe	157,500 ft
Time Allowed for Completion:	450 days

COMPLETING TRACY PUMPING PLANT AND INSTALLING EQUIPMENT
Central Valley Project, California

Location: About 9 miles northwest of Tracy, Calif.

Work: Completion of Tracy Pumping Plant involving placing of concrete flo finish; installation of six 4,600 cfs capacity pumps, six 22,500-hp synchronou motors, and other equipment; and construction of 4,200 ft of wood-pole transmission line consisting of 440-volt 3-phase, distribution line and conducto control cable.

Installing pumps	1,570,000 lb
Installing single conductor	73,000 ft
Bonded concrete floor finish	4,700 sq yd
Furnishing and installing ½- to 4-in. diameter conduit	17,600 ft
Installing power and control cable	42,600 ft
Time allowed for Completion:	285 to 650 days

WYOMING CANAL
Riverton Project, Wyoming

Location: About 20 miles north of Riverton, Wyo.

Work: Construction of earthwork and structures for about 12 miles of the Wyoming Canal.

Excavation	970,000 cu yd
Concrete	4,300 cu yd
Furnishing and placing reinforcing steel	356,000 lb
Furnishing and driving steel piling	98,000 lb
Furnishing and erecting structural steel	39,000 lb
Furnishing and erecting timber	213 Mbm
Time Allowed for Completion:	730 days

TRANSMISSION LINE
Missouri River Basin Project, Wyoming

Location: Between Boysen and Thermopolis, Wyo.

Work: Construction of 18 miles of 115-kv, wood-pole, 3-phase, single-circuit, H-frame transmission line with two overhead ground wires. The contractor is to furnish all materials.

Time Allowed for Completion: 550 days

STRINGING CONDUCTOR AND OVERHEAD GROUND WIRE
Davis Dam Project, Arizona-Nevada-California

Location: Between Davis Dam and Boulder City, Nev., and between Davis Dam and Parker Dam, Calif.

Work: Stringing conductor and overhead ground wire for about 70 miles of 230-kv, 3-phase, single-circuit transmission line between Davis Dam and Parker Dam, and for about 64 miles of 230-kv, 3-phase, single-circuit transmission line between Davis Dam and Hoover Dam. Materials are to be furnished by the government.

Time Allowed for Completion: By July 1, 1950

HIGHWAY RELOCATION
Palisades Project, Idaho

Location: About 56 miles southeast of Idaho Falls, Idaho.

Work: Relocation of about 2 miles of state highway at Palisades Reservoir.

Excavation (common)	320,000 cu yd
Excavation (rock)	50,000 cu yd
Time Allowed for Completion:	180 days

NEW SURVEYING
MICRO *Altimeter*

Graduations:
ONE FOOT
Range:
6,000 FEET

Another FIRST by the makers of the established world standard in accuracy and dependability . . . the new Surveying MICRO Altimeter for all field and mine ventilation surveys . . . Constructed for lifetime service of finest materials to highest standards . . . exclusive friction-free, zero-gauging principle. Equipped with rugged leather carrying case, magnifier, thermometer and operational procedures.

Model M 1 illustrated . . . other models available . . . see your dealer or write direct.

SURVEYING MICRO ALTIMETER

AMERICAN PAULIN SYSTEM
1847 S. Flower Street, Los Angeles 15, California

"Maybe it's the water, Mary, better boil it."

The virtual banishment of typhoid and other water-borne diseases, within the past 50 years, must be largely credited to those men responsible for the design, construction and operation of water supply systems. Modern water purification processes had their beginning only a few years before our Company was established in 1899. Today, (where necessary to make it safe), water is processed by over 5,000 of the more than 12,000 public water supply systems serving 85 million Americans.

The growth and progress of the gas industry and sanitation service during the past half-century has been equally remarkable. Today, over 20 million families use gas for cooking, refrigeration and space and water heating. More than half of our urban population is now served by 6,000 sewage treatment plants.

For 50 years, our Company has contributed to the growth and progress of these public services by providing cast iron pressure pipe for water, gas and sewer mains, and for water purification and sewage treatment plants. We have matched their progress with a half-century of progress of our own in manufacturing methods, production standards, quality controls and facilities for research and development.

To those responsible for the great progress in water supply, gas and sanitation service and their contribution to better health and living over the past fifty years, America pays tribute.

U.S.
CAST IRON
PIPE

1899-1949
U. S. Pipe & Foundry Co.
Makers for 50 years of cast iron pipe for water, gas and sewerage service.
General Offices: Burlington, N. J.

Philippines Initiate Hydro Construction Program

(*Continued from page 27*)

The total fall of the Agus River from the lake to the sea is 2,300 ft, which is absorbed in a total river length of 22 miles, or a mean slope of 1:52. It is planned to select for development only those sections of the river which have comparatively steep slopes. Under the present plan seven sites have been selected having a total gross head of 2,200 ft, or 95 percent of the total drop available in the river. The total effective head of the seven sites is 93 percent of the gross head.

The initial development in the basin will be at Maria Cristina Falls, the most favorable and economical site on the Agus River, about a mile and a half from its mouth at Iligan Bay. The dam will be at the head of the rapids immediately above the falls, and the powerhouse will be just below the falls. This plan provides the maximum head possible. In view of the limited initial demand for power, the installation will consist of only two units of 40,000 kw each, out of the ultimate five contemplated for this plant.

For the initial installation, a flow of 2,200 cfs will be required, at an effective head of 500 ft. In the 11 years of record, this flow has been available all year round except during three years. Thus partial regulation of the flow of the river at the lake outlet would have been necessary only during these dry years. The energy output of the initial installation will be 550,000,000 kwhr during dry years and 700,000,000 kwhr during wet years.

Plans call for a concrete diversion dam above Maria Cristina Falls with provision for the future installation of crest roller gates. A reinforced concrete intake will bypass the water through a cut-and-cover conduit into the surge tank, whence it will drop through steel penstocks into the power plant. The powerhouse will be constructed with two units, and the space allowed for the third unit will be used as a working bay.

At present prices of materials and labor, the estimated cost of the initial installation is $11,700,000, and the annual fixed and operating expenses amount to $1,110,000. Based on the generation of 529,000,000 kwhr annually, the unit cost of power production will be about 2 mills per kwhr.

Work on all the projects mentioned is planned to start in 1949. After prolonged negotiations, the International Bank for Reconstruction and Development has indicated its intention of financing the initial project on the Agno River (Ambuklao) up to the amount of foreign exchange required, a total of $15,000,000. The Philippine Government will provide the sums to be expended locally for that project. The small projects are also going forward—financed largely from the income of the National Power Corporation.

When the present program has been completed, the Philippine nation will have taken a long stride in the development of its power resources, thus meeting the pressing need for power, bringing down the cost of electricity, accelerating economic and industrial growth, raising the standard of living of its 16,000,000 people, and promoting their happiness and security.

◆

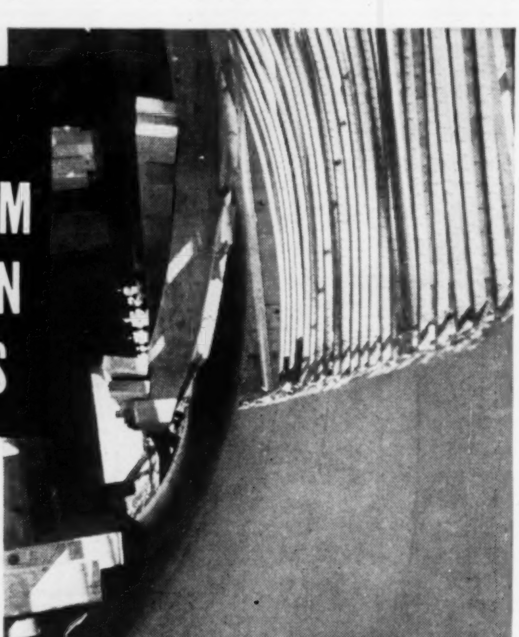
Dutch Railway Drydock Speeds Prefabricated Barge Assembly

(*Continued from page 29*)

barge is started. The transfer from one position to the next is accomplished by a two-drum winch and wire-rope tackle. By the time the third barge has been initially assembled, the first one is completed and painted, ready for transfer to the cradle for launching.

The first barge was launched late in December 1947, and operations have continued since that time. When the barge construction program

BUILDERS OF SAN ANGELO DAM USE HYDRON ON CURVED FORMS



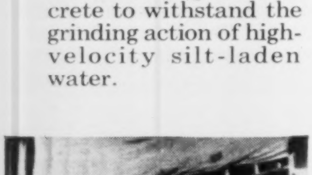
Shown at the right is a tunnel section of the San Angelo Dam, San Angelo, Texas. The concrete was cast against Hydron Form Linings which provide a smooth, pit-free surface, enabling the concrete to withstand the grinding action of high-velocity silt-laden water.

Hydron absorbs excess water and eliminates trapped air from the surface. This makes the concrete several times more resistant to abrasion and freeze-thaw conditions. The case hardening effect is gradual from the surface into the mass for about an inch.

Hydron is mounted on wood forms with rapid fire staple guns and on steel forms with a special adhesive. Furnished in flexible sheets, Hydron can be easily cut or trimmed.

Other big installations on which Hydron was used are: Fall River Dam, Norfork Dam, East Sidney Dam, Whitney Dam, Cherry Creek Dam, Soo Canal and lock walls, Chain O' Rocks Canal, Delaware & Chesapeake Canal bridge abutments, Maine Turnpike bridge abutments.

For more information write Hydron Sales Department, United States Rubber Company, 1 Market Street, Passaic, N. J.



Using a curved hinged form on the upper 300° with Hydron Form Linings. Hydron can also be used on lower 60°. After floating concrete apply Hydron and weight down with 2" of sand.

A PRODUCT OF

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES
RUBBER COMPANY

is completed, the drydock is to be used for the repair of Rhine barges, those requiring extensive repairs to be transferred to the yard area leaving the drydock available for other craft.

Because of the scarcity of materials in Holland and Europe generally, when the drydock was built, and the slow delivery of most items from America, all possible sources were sought for earliest delivery. Thus the wood piling, electric motor and controls were obtained in Belgium; the structural steel, reinforcing bars, crane rails, wrought-iron chain, and most of the cement came from France; the steel gears were made in England; the Douglas fir planking came from Canada; and the steel chain, oak timber, iron and steel castings were shipped from the United States.

This project was designed and supervised by Crandall Dry Dock Engineers, Inc., Cambridge, Mass., for the Office National de la Navigation of the Republique Francaise, through the French Mission of Public Works in Washington, D.C. Messieurs F. Beau and Leroy were the active directors of the Office National de la Navigation in Paris, assisted by Monsieur J. Collignon. Captain H. Brugerolle was the head of the French Mission in Rotterdam having general supervision of the project. The concrete work, pile driving and earthwork were executed by Volker Beton of Sliedrecht, and the other work by the forces of de Biesbosch. Vernon I. Hight and Paul S. Crandall, Jun. ASCE, were resident engineers for Crandall Dry Dock Engineers, Inc.

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New Publications

(*Continued from page 76*)

Heating, Ventilating, Air Conditioning. The 1949 edition of the *Heating, Ventilating and Air Conditioning Guide*, containing a 992-page technical data section and a 392-page catalogue section of the latest manufacturers' products, has been issued by the American Society of Heating and Ventilating Engineers. The Guide sells for $7.50, and is available from the ASHVE through the office of the secretary, 51 Madison Avenue, New York 10, N.Y.

Engineering Research. Engineers and scientists who have to report their work and methods to laymen will be aided by a new booklet, entitled *Telling the Story of Engineering Research*, published by the Engineering College Research Council of the American Society for Engineering Education. The 52-page illustrated booklet consists of addresses by seven well-known editors and science writers given at the winter meeting of the Council in November 1948. Copies may be purchased from the Office of the Chairman of the Council at the State University of Iowa, Iowa City, Iowa, for 50 cents each.

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Rectangular Chart Type Meters
Air Release Valves
Pitot Recorders
Wash Water Gauges

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Filter Gauges
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Pitot Rods
Flow Nozzles
Air Inlet Valves

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Portable Manometers
Insert Type Venturi Tubes
Venturi Tubes
Type "S" Parabolic Flume
Dry Chemical Feeder

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Recent BOOKS

Elements of Applied Hydrology. By Don Johnstone and W. P. Cross. Ronald Press Co., New York, 1949. 275 pp., illus., diagrs., charts, maps, tables, $9^1/_2 \times 6$ in., cloth, $5. Intended for use as an undergraduate text, this book sets forth some of the fundamentals of hydrology and encourages an analytical approach to the solution of problems. A knowledge of the Bernoulli theorem, general concepts of uniform flow in open channels, and critical depth and energy gradient is assumed as well as elementary calculus and the concept of least-squares adjustment. References are given at the end of each chapter and sets of problems at the text.

Numerical Methods of Analysis in Engineering (Successive Corrections). By H. Cross and others, a Symposium at Illinois Institute of Technology, Chicago, Ill., arranged and edited by L. E. Grinter. The Macmillan Co., New York, 1949. 207 pp., illus., diagrs., charts, tables, $9^1/_2 \times 6^1/_4$ in., cloth, $5.80. This volume contains papers on methods and techniques of numerical analysis which are applicable in many fields of engineering and science. Divided into four sections, the first three discuss numerical methods based upon physical concepts, numerical solutions of equations for state of stress, and applications of numerical methods to heat transfer. Surveys and bibliographies of numerical methods make up the final section.

Principles of Structural Geology. 4 ed. By C. M. Nevin. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, 1949. 410 pp., illus., diagrs., charts, maps, tables, $9^1/_4 \times 6$ in., cloth, $6. Written as a college text, this book deals with the earth's framework and the causes of its distortion. In this fourth edition the text is expanded and thoroughly revised. A chapter has been added which presents the solution of problems that arise in the field and in the preparation of maps and reports. Laboratory exercises are now included, and source material is now limited to selected references at the end of each chapter. Separate base maps are included for use with the problems.

Engineers of the Southwest Pacific 1941–1945, Volume I, Engineers in Theater Operations by the Office of the Chief Engineer, General Headquarters, Army Forces, Pacific, Reports of Operations United States Army Forces in the Far East Southwest Pacific Area. Office of the Chief of Engineers, Washington, D.C., 1947. 375 pp., illus., maps, $11^3/_4 \times 9$ in., cloth, $5. This report sums up in one general volume the scope of the activities of the Corps of Engineers in the Southwest Pacific during World War II. At the same time it serves as an introduction to the detailed volumes which will follow. An abundance of references to source material is given in footnotes. Every effort has been made to depart from strictly engineer vernacular, and a series of clear and effective maps and photographs helps materially in following the text..

Soil Mechanics for Civil Engineers. By B. H. Knight. Longmans, Green & Co., New York; Edward Arnold & Co., London, 1948. 255 pp., $8^3/_4 \times 5^1/_2$ in., cloth, $5.25. The basic topics covered in this volume are the properties, sampling, testing and classification of soils, drainage and compaction, load stresses, and stabilization. Considerable emphasis is laid on the applications of soil mechanics to highway engineering problems. Complicated mathematical proofs are omitted. References to further study material are included.

Streamline Flow. By H. F. P. Purday. Constable & Co., Ltd., 10 Orange Street, London W.C.2, 1949. 185 pp., diagrs., charts, tables, $8^3/_4 \times 5^1/_2$ in., cloth, 18*s*. This book is an introduction to three closely related parts of physics: Mechanics of non-turbulent flow; the flow of heat by conduction; and heat transfer between solids and fluids in states of non-turbulent flow. There is a three-fold emphasis on physics, mathematics and technical application. Only an elementary knowledge of the calculus is assumed. A short bibliography is included.

PRACTICAL DESIGN OF SIMPLE STEEL STRUCTURES. Volume II, Girders, Columns, Trusses, Bridges, etc. By D. S. Stewart. Constable & Company, Ltd., 10 Orange Street, London, W.C.2, 1948. 289 pp., diagrs., charts, tables, plates, 8¾×5½ in., linen, 20s. Intended for use by civil, structural, and municipal engineers, and students, this second volume deals with girders, columns, trusses, and bridges. The complete work provides a detailed guide to the design of structures. One feature of the text is the separation on facing pages of calculations and explanatory text. Fabrication by welding is not considered. The tables that originally formed the third volume are now included in the first volume.

TABLES OF THE BESSEL FUNCTIONS OF THE FIRST KIND OF ORDERS FORTY THROUGH FIFTY-ONE. (Annals of the Computation Laboratory of Harvard University, Volume XI.) By the Staff of the Computation Laboratory. Harvard University Press, Cambridge, Mass., 1948. 620 pp., tables, 10¾×7¾ in., cloth, $10. Continuing the series of tables computed by the automatic sequence controlled calculator, the present volume extends the coverage of Bessel functions of the first kind. Computational techniques and the calculator itself are described in earlier volumes on the series. As before, the tables are carried to ten decimal places.

TABLES OF THE CONFLUENT HYPERGEOMETRIC FUNCTION $F(^n/_2, ^1/_2; x)$ AND RELATED FUNCTIONS. (National Bureau of Standards, Applied Mathematics Series 3.) United States Government Printing Office, Washington, D.C., 1949. 73 pp., diagrs., tables, 10¼×8 in., paper, 35 cents. These tables, of importance in connection with the so-called analysis-of-variance tests, are also intended to facilitate the construction of other tables needed for sequential analysis and various other statistical tests. They are carried out to six decimal places. The analytical properties of the function are discussed, and a group of interpolation charts is included with explanation.

TABLES OF GENERALIZED SINE- AND COSINE-INTEGRAL FUNCTIONS: Parts I and II (Annals of the Computation Laboratory of Harvard University, Volumes XVIII and XIX). By the Staff of the Computation Laboratory. Harvard University Press, Cambridge, Mass., 1949. Pt. 1, 462 pp.; Pt. 2, 560 pp.; charts, tables, 10¾×8 in., cloth, $10 each volume. The introduction to this two-volume set describes the characteristics, computation, and interpolation of the functions considered. The six-place tables, expanded from short tabulations prepared for war work, are useful mathematical tools for the investigation of such questions as self and mutual impedances, radiation resistance, and distribution of current in antennas and antenna arrays of various types.

TECHNIQUE DES TRAVAUX, Traité de Pratique des Travaux, Constructions, Bétons, Travaux Publics, 2 Vols. By M. Jacobson. Librairie Polytechnique Ch. Béranger, Paris, France and Liége, Belgium, 1948. 1020 pp., diagrs., charts, tables, 11×7 in., cloth, 3,700 fr. each vol. Essentially of a practical nature, these volumes consider the difficult and critical problems which construction engineers encounter in the course of their work. The reasons for choosing various technical solutions, methods of execution, and an up-to-date bibliography permit the study of special questions in minimum time. Volume I considers foundations, concrete and mortars, and design and construction details of railways, aqueducts, airports, etc. Volume II discusses highway techniques, bridges and viaducts, and the general organization of a wide range of projects and construction jobs. Tables and diagrams are extensively and effectively used.

THEORY OF MODERN STEEL STRUCTURES, Volume II. Statically Indeterminate Structures and Space Frames. Revised Ed. By L. E. Grinter. Macmillan Co., New York, 1949. 312 pp., illus., diagrs., charts, tables, 9½×6 in., cloth, $5.25. Intended as a text for advanced undergraduates, this volume considers statically indeterminate structures and space frames in a detailed manner. The largest changes in the revised edition occur in the material on the analysis and design of indeterminate structures, of arches and closed rings, and of continuous frames by moment distribution. Problems are found in the text along with the section to which they relate.

WATER SUPPLY ENGINEERING, 4 ed. By H. E. Babbitt and J. J. Doland. McGraw-Hill Book Co., New York, Toronto, London, 1949. 637 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $6.50. In this new edition, the authors have extended their policy of emphasizing practical applications. A discussion of theories, such as is available in other textbooks has, in general, been omitted. Applications of theories to practice are given in the cases of finances, hydraulics, pumping machinery, electrical equipment, and water purification. New chapters have been included on intakes, aqueducts, and pipelines. Revisions and additions are made to emphasize the timeliness and utility of the information presented.

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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

New Building Products

A LINE OF ADHESIVES, has recently been announced. Named "3M" brand Building Products, the line features four coatings, one sealer, one caulking compound, and a complete line of adhesives for floor and wall coverings. Among the adhesives are ceramic tile adhesive, linoleum adhesive and sealer, a rubber tile adhesive, and a glass tile adhesive for interior applications. Waterproofness, permanent resilience and ease of handling were cited as advantages. Applicator items include four coatings, a waterproof masonry sealer and a general caulking compound described as 99% solids, waterproof, shrinkproof, and permanently pliable. **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**

◆

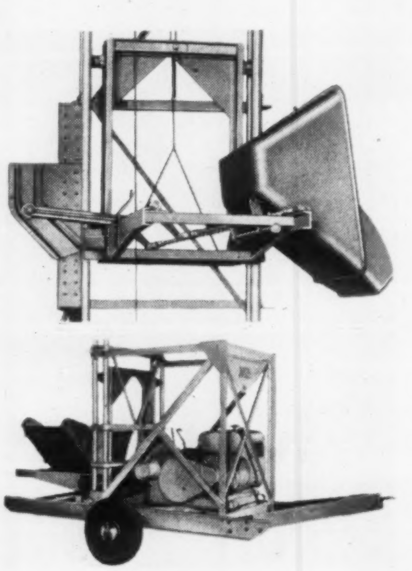
Truck Crane and Carrier

INTRODUCTION OF A truck crane and carrier combination has been announced. The crane has a capacity of 20 tons. The minimum boom length for crane work is 30′ and this boom is extendible to 100′ length by addition of standard intermediate sections. Detailed attention has been given to design from the standpoint of assuring simplicity and ease of maintenance. Main operating machinery of the crane is mounted on cast steel side frames. All high-speed shafts are mounted on ball or roller bearings. The "Feather-Touch" clutch control, which utilizes the power of the engine to throw heavy drum clutches, uniform pressure swing clutches and a high-speed, power-controlled boom hoist, independent of all other operations, are standard equipment. The carrier has a box type truck frame that is reinforced the full length of the carrier. The method of attaching the crane lower base to the carrier permits the transmission of loads evenly over the top and sides. Outriggers extend the full width and have unusual bearing support when extended. **The Northwest Engineering Co., 135 South La Salle St., Chicago, Ill.**

Truck Crane with "Feather Touch" Clutch Control

Hoist-Tower Accessories

FOR BUILDING AND ROOFING contractors, two new accessories for Jaeger's self-raising hoist tower have been announced. Completely interchangeable with the 5′6″ x 5′9″ material platform which has always been standard equipment for the tower, is a new $^{1}/_{2}$ cu yd concrete bucket which fits on the same frame and can be easily adapted to towers now in service.



Concrete Bucket and Transporter

The bucket is roll-over type and will hold the full load of an 11-S concrete mixer. It descends to a low level to permit loading directly from concrete mixers at ground level, or from truck mixers. Bucket discharge is automatic, and discharging levels may be regulated in 3 in. increments at any point from 10 ft above ground to within 5′6″ of the top of the tower. A positive-acting safety device prevents material platform or concrete bucket falling. A new trailer-transporter accommodates the largest unit of the base section and engine-driven hoist. With it, the tower is readied for transport easily and quickly, and the contractor's truck carries only the upper tower sections and braces. The rugged wheel-and-axle assembly is merely rolled under the sled runner base of the tower and bolted securely by means of U-clamps. The structural steel towshaft bolts to those same runners, at an angle which makes for easy hitching to the truck and level towing. Wheels are heavy-duty automotive type with Timken bearings and 5:00 × 16, 6-ply tires. For further information write for Bulletin HS-9. **Jaeger Machine Co., Columbus 16, Ohio.**

Light Weight Breaker

INTENDED FOR FAST demolition work and for use wherever footing is treacherous, a paving breaker, weighing only 38 lb, has been added to the Gardner-Denver line. The paving breaker, known as the B37, incorporates the features which have made the B67 and B87 machines so popular. Although light in weight, the B37 is said to be exceptionally sturdy. Long-life features of the breaker include a renewable chuck liner, easily replaced at low cost, avoiding the greater expense of replacing the entire chuck end. The hammer is of the block type pistol type, reversible for longer life. The use of a tappet minimizes wear on the hammer striking face, and the tappet operates in a renewable bushing. The throttle valve lock, which works like the "safety" on a gun, enables workmen to avoid accidents. **Gardner-Denver Co., Quincy, Ill.**

◆

Vitrified Clay Skip-Pipe

A NEW DRAINAGE SYSTEM, recently completed, provides for interception and removal of surface and underground water from air fields and adjacent areas. At Grand Haven, Michigan airport, 5430 lineal ft of 6″ drainage pipe and 2250 ft of 8″ pipe now underlie the field's two 4300 foot runways and one 2400 foot runway. Vitrified clay skip-pipe was used for the underdrain system. Motor joints are unnecessary and special lugs in the bell make correct alignment near-mechanical. In addition, water collected in the cradle top of the pipe enters the pipe in such a way that a hydraulic impulse is exerted, accelerating the flow of water within the pipe, and increasing drainage system capacity. Average depth of trenches was 5 ft with all trenching handled by a Koehring #304 with back-hoe attachment. 550 cu yds of porous back-fill were used in covering the pipe. **The Robinson Clay Product Co., Akron, Ohio.**

Section of New Drainage System

Equipment, Materials & Methods (Continued)

Shovel & Crane Power Units

THREE NEW RUBBER-TIRED machines, the Types 34-T, 34-M and 604-M have been announced. The 34-T is mounted on a truck chassis with independent power. Standard equipment includes a 5 speed main transmission and 2 speed auxiliary transmission which facilitates 10 speeds forward and 2 reverse. The adaptor casting which includes the machined roller paths and internal swing gear is welded to the truck frame. The 34-M is a self-propelled unit with one engine mounted in the rotating assembly supplying the power for all operations including propelling in either direction. This power is transmitted from the standard reversing clutches in the rotating assembly through a special train of gears and the vertical propel shaft to the wheeled mounting. Service brakes are on all wheels and are operated by air. The 604-M rotating assembly incorporates the basic features of the Lima 604, but with alterations to facilitate adaption to truck mounting.

Crane Power Unit In Operation

One engine, mounted in the rotating assembly, supplies the power for all the operations including propelling in either direction. Rigid type outriggers are standard equipment. The carrier is equipped with oscillating tandem type rear axles, which provide extra flexibility when working on uneven terrain. **Lima Shovel & Crane Div., Lima-Hamilton Corp., Lima, Ohio.**

◆

Pipe System

THE "SPEED-LAY" PIPE SYSTEM is used for temporary or semipermanent installations of water, gas, or air lines and is available for sale or rental. The pipe is light wall for use with pressures up to 150 psi and is available in sizes from 2" to 12" and in lengths of 20 ft. It is furnished either black or galvanized, with the latter being recommended for semipermanent installations. Each length of pipe is furnished with an easily assembled coupling which provides for rapid make-up

(*Continued on page 88*)

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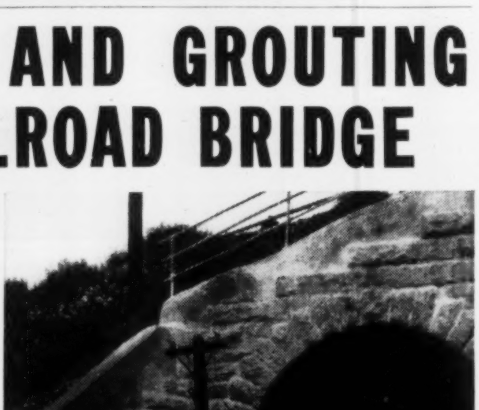

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Equipment, Materials & Methods (Continued)

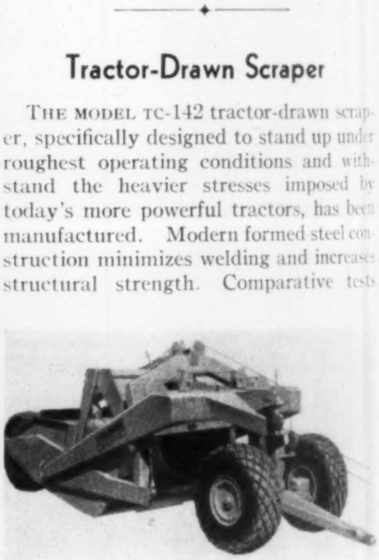
in the field. The coupling is a single "all purpose" pipe joint, combining the features of a straight line coupling, a flexible coupling, an expansion joint, a union, and a mechanically locked joint. A few turns of a simple speed wrench and the coupling is made up. The fittings are of the victaulic full-flow type, designed to reduce frictional losses and to give more efficient flow. Bends are of a long radii, with wide full sweeps and can be swiveled and set at any angle through 360°. They act, in effect, as swing joints. Another feature of this pipe system is that the use of the victaulic coupling permits the laying of the pipe without the necessity of anchoring it. An attractive and instructive brochure is available upon request. **Albert Pipe Supply Co., Brooklyn 11, N.Y.**

"Speed-Lay" Pipe Coupling

◆

Tractor-Drawn Scraper

THE MODEL TC-142 tractor-drawn scraper, specifically designed to stand up under roughest operating conditions and withstand the heavier stresses imposed by today's more powerful tractors, has been manufactured. Modern formed steel construction minimizes welding and increases structural strength. Comparative tests show faster loading characteristics than previous models as a result of new 3-piece cutting edge. Wider 65-in. front apron opening and newly designed curved bowl ejector have been added to achieve faster complete discharge of load. High yoke and ground clearance have been achieved, together with low center of gravity, short wheel base, and equalized weight distribution, to permit increased stability and maneuverability over all types of terrain. **Wooldridge Mfg. Co., Sunnyvale, Calif.**

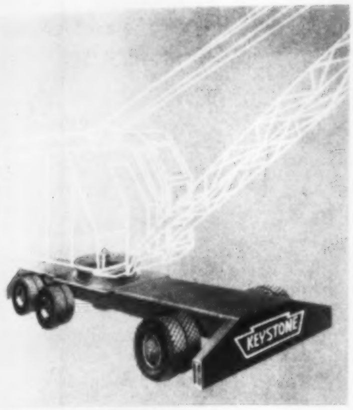


Model TC-142

Equipment, Materials & Methods (Continued)

Krane Karriage

A ONE-MAN, SELF-PROPELLED mounting for all makes of cranes from 10–25 ton capacity, is now presented. Propulsion power is obtained through the travel clutches and vertical travel shaft of the crane. The karriage is equipped with a four speed transmission with a speed range of 2-10 mph in either direction. There is a complete control of the entire machine from the operator's seat in the cab regardless of its position on the karriage. Short turning radius for narrow roadways make it ideal for close work. Air operated brakes on all wheels and hydraulic steering assure complete control of the rig with safety. Distribution of the karriage is through the crane and shovel manufacturers, their dealers or distributors. Equipment Div., Keystone Driller Co., 419 Wood St., Pittsburgh 22, Pa.



Self-Propelled Karriage

◆

Ground Movement Preventative

OVER THE YEARS many methods of stopping mass ground movements in cuts and fills on highways and railroads have been used. These methods ranged from costly stone or concrete bulkheads, piling, shoring and many others. The major reason for the difficulty has almost always been the presence of subsurface water. During recent years a new method of using Hydrauger machines to bore horizontal drainage holes has been utilized by both state highway departments and large railroad companies. In one state many hundreds of thousands of feet of slightly sloping hole have been prepared by Hydraugers for the insertion of perforated liners. The results are said to be good and the cost relatively low. Usually 4 in. bored and reamed holes placed at predetermined spacings have proven adequate. The Hydrauger machine was originally developed for installing pipelines and drainage systems under highways and paved streets. It is operated by compressed air and can produce bores up to 200 ft in length. On an average, 50 ft of 4½ in. hole can be bored per hr of operation. Hydrauger Corp., 681 Market St., San Francisco, Calif.

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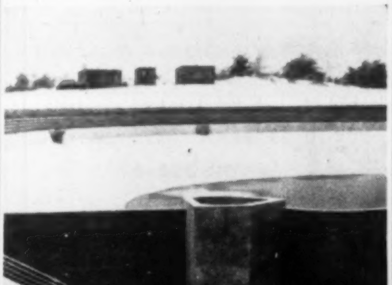

Fig. B-144-A

One of Two 48" Type M Gates installed in Ft. Stanton Park Reservoir, Washington, D. C., to maintain direction of flow. See Feb. 22, 1944, issue Engineering News Record for story about this project.

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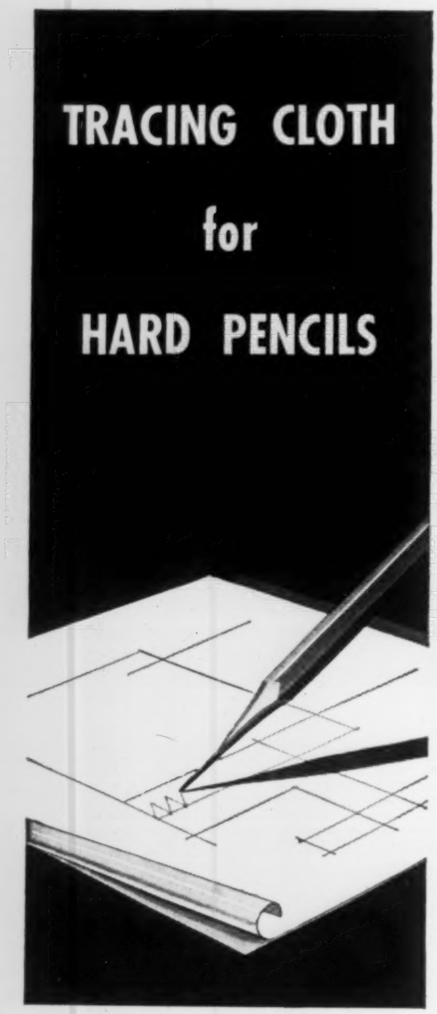

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Equipment, Materials & Methods (Continued)

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The economy and efficiency of fluorescent lights is no longer restricted to inside use alone. After many months of successful outside tests, the new all-weather fluorescents are now in volume production and wide usage is predicted. These new lights are reported to benefit the community in greater economy, magnificent lighting, street modernization and greater business activity. Fuorescent light gives approximately $2^1/_2$ times more light per power dollar. In addition, the new Post-Lites are glareless so that they can be installed at the level of use from where they radiate a brilliant pleasing white light in all directions. This eliminates the wasteful light loss from highup reflected lights. Post-Lites are beautiful, on or off; streamlined for up-to-date modernization. The unit has eight 40-watt tubes or 320 watts equivalent to approximately 1000 watts incandescent. Attaches to pipe posts set in concrete. **W. H. Long Co., 61 W. Hubbard St., Chicago 10, Ill.**

Modern, Economical Lighting

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Literature Available

Steel Forms—A 6-page bulletin on steel forms for concrete highways and airports has just been announced. It covers exclusive features of the standard highway form and also details such special forms as the dual duty airport form, integral curb forms, extension forms, safety zone forms, stake pullers and miscellaneous accessory equipment. Copies of Bulletin K-19 are available by writing **The Heltzel Steel Form & Iron Co., Warren, Ohio.**

Motor Grader—A 24-page booklet designated as Form 485 contains useful information on the Adams No. 610 100 hp motor grader. Illustrations, diagrams, specifications, and dimensions are included in this booklet on ditching, surface mixing, bank cutting, scarifying, snow removal, road and street maintenance. **J. D. Adams Mfg. Co., Indianapolis, Ind.**

Locomotive Crane—Catalog No. 600-L-6 offers detailed information on a 30 ton diesel locomotive crane. The 20-page catalog contains illustrations of the crane in different types of work. Many mechanical illustrations are also included. The catalog may be obtained by writing the **Advertising Dept. American Hoist & Derrick Co., St. Paul 1, Minn.**

Pole Buyers' Guide—An 18-page technical bulletin planned as an informative guide for users and buyers of poles is available. The "Pole Buyers' Guide" presents service records, electrical resistance information, and comparative cost figures of pressure-creosoted poles. The booklet gives the manufacturing requirements for bark removal, sawing, trimming, framing, and marking poles and defines widely used wood terminology. **Koppers Co., Inc., Wood Preserving Div., Koppers Bldg., Pittsburgh 19, Pa.**

Dispersed Black—A 4-page folder offers detailed information on A E dispersed black, which is used in darkening air entrained concrete. It is used for traffic lane markings, prevention of ice formation on highways and etc. The folder describes how to use the product and also tells results on tests of carbon and A E dispersed black. **A. C. Horn Co., Inc., 10th St. & 44 Ave., Long Island City 1, N.Y.**

New Products Booklet—To help the business community keep a practical eye on the flood of new products now rolling off production lines, more than a thousand new products and services now ready for marketing have just been compiled into a compact 80-page booklet titled "New Products." The new compilation offers a detailed description of the innovations of more than 750 different manufacturers, classified by industry and completely indexed by name and address of each producer. Features of the comprehensive compilation include food processing equipment, multi-purpose packaging and vending machines, liquid stainless steel, prefabrication techniques, and new industrial safety equipment. Price is 50¢. **N.Y. Journal of Commerce, 63 Park Row, New York, N.Y.**

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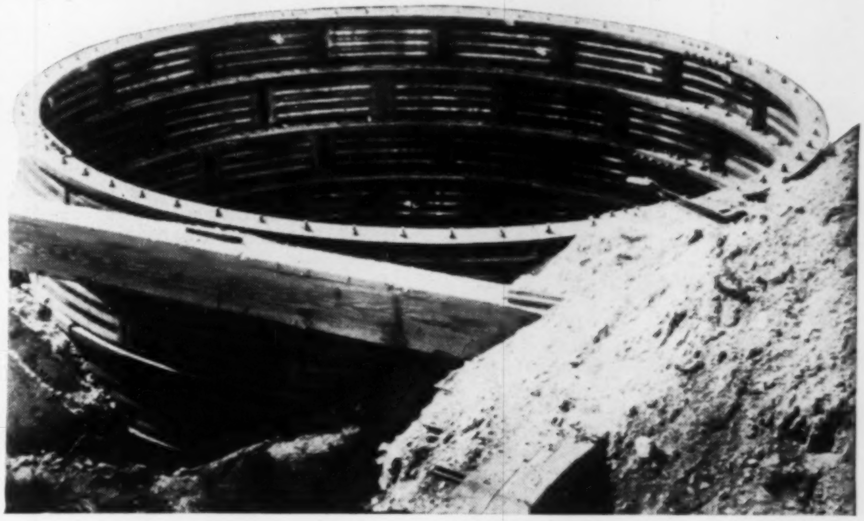

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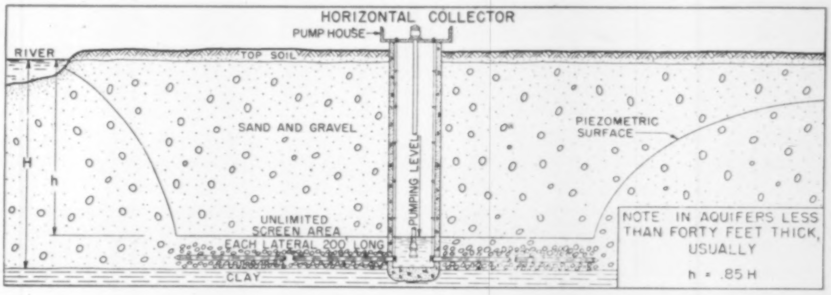

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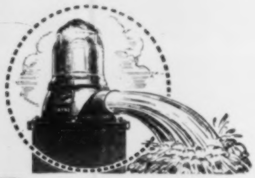

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Literature Available (Continued)

Canvas Products—An attractive 4-page 2-color circular describes various roofing and deck cloths, tarpaulines, drop cloths and mop yarns. Instructions for laying, size dimensions, and pictures are combined to form this worth-while offer. **C. D. Daniels, Inc., Daniels, Maryland.**

Incineration—An 8-page booklet gives detailed information on a new mechanically stoked incinerator. The booklet is profusely illustrated with pictures and diagrams. Upon request, suggested layouts and sample specifications will gladly be furnished to municipal officials and consulting engineers. **Morse Boulger Destructor Co., New York 17, N.Y.**

Plywood Information—"State of the Industry" is the title of a 16-page report on the Douglas fir plywood industry as of today. The information is in the form of excerpts from a report to the New York Society of Security Analysts. The folder contains an insert of facts regarding the number of plants in production as well as the properties of plywood, markets, research and long range factors. **Douglas Fir Plywood Assoc., Tacoma 2, Wash.**

Crane Carrier Bulletin—A descriptive bulletin combining complete description and specifications of the Byers Model 83-CC crane carrier, has been released. Bulletin No. 249 describes all the features of the crane carrier's 35 mph truck-type chassis upon which is mounted a heavy-duty $^3/_4$ cu yd upper deck capable of lifting crane loads up to 20 tons and is convertible to all front-end attachments. **Byers Machine Co., Ravenna, Ohio.**

New Paving Features—A 4-page folder on two new design advancements now featured as standard equipment on the Rex pavers has just been published. The new hydraulic bucket provides positive control of spreading. The opening action of the pivoted gate can be stopped at any desired point. The redesigned Rex boom can be elevated to provide a 10 ft bucket clearance at the end of the boom. These two new features are illustrated and fully described in Bulletin No. 49-17. For your copy, write **Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.**

Form Lining—A new manual on Hydron absorptive form lining used in the construction of smooth, durable concrete surfaces has been published. The manual discusses methods of installation, relative costs, applications, and specifications. It quotes statistics to prove the advantages of concrete forming with Hydron over wood forming. Hydron avoids concrete surface imperfections by absorption of air and water and by increasing surface density and abrasion resistance. The result is said to be less surface wear, and lower maintenance costs. **United States Rubber Co., Rockefeller Center, New York 20, N.Y.**

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